FEBRUARY 1953

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FEBRUARY 1953
Vol. 11 No. 2

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PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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LETTERS TO THE EDITOR

RATIO OF DIE CASTING ALLOYS

As subscribers we read (probably a few years ago) in Die Castings, a survey from American industry concerning the quantities used of zinc-alloys compared with other materials in die-casting. Unfortunately the copy in question has been filed away in our office.

If we remember rightly, the figures were approximately as follows:

Zinc alloys	90%
Aluminum	5%
Brass and other metals	5%

As we need the figures published in the above mentioned number of Die Casting for a special purpose, we would appreciate very much if you could send us these. — E. A. (Norway).

According to figures compiled by the American Die Casting Institute, ratio of various die casting alloys in 1951 was approximately as follows:

Zinc	*226,000 tons*
Aluminum	*64,000 tons*
Other alloys	*17,500 tons*

These figures include both contract and captive die casting plants. An estimate of magnesium die castings, included under the heading "other alloys", shows 3,500 tons. — Ed.

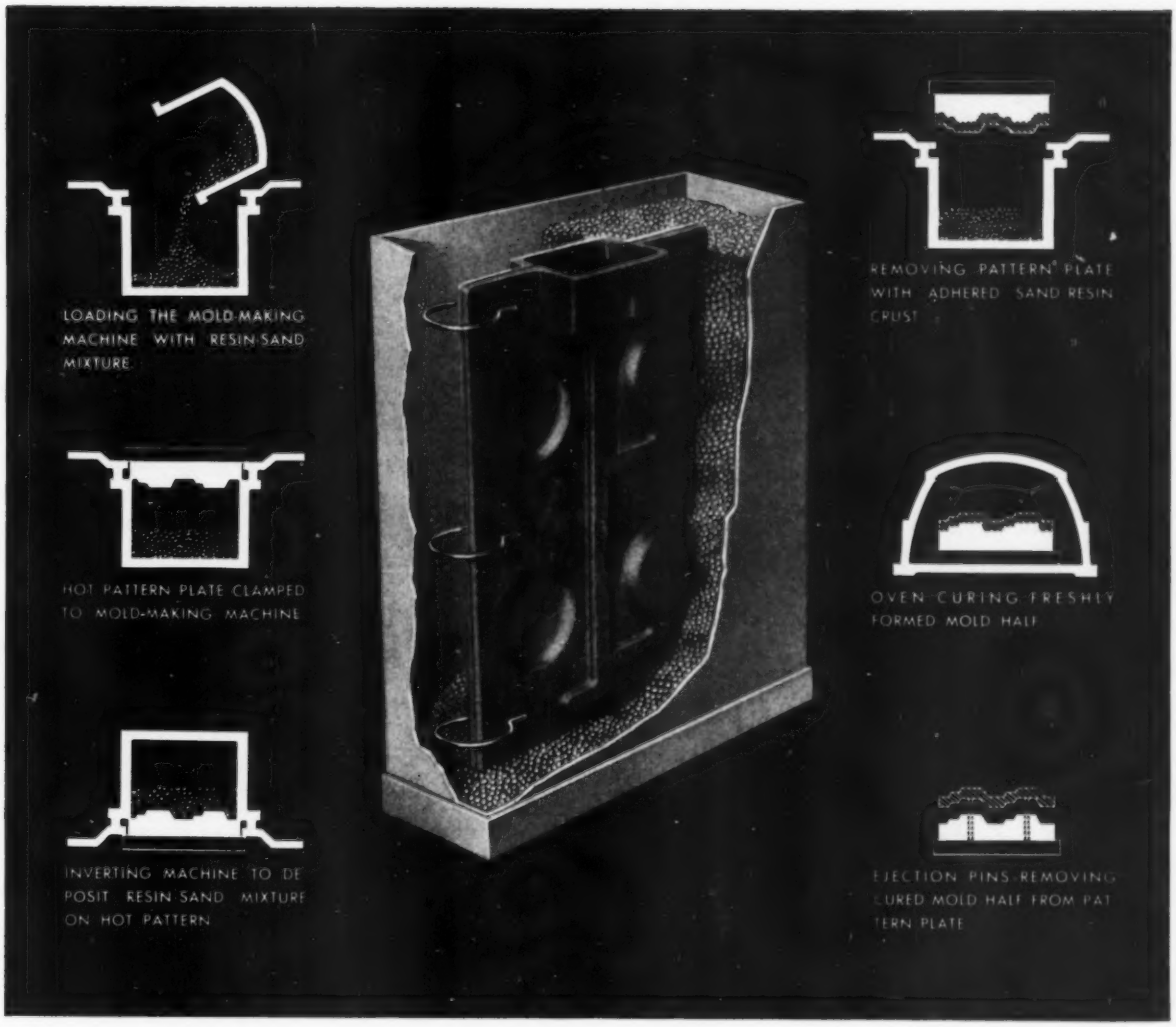
SHELL MOLDING

We are subscribers of PMM and find your publication highly useful and interesting in our business.

We are at present time seriously considering the shell molding or Croning process as a supplement to our other forms of casting of metals.

We would be very grateful if you would kindly forward us names of suppliers of ma-

continued on page 6


LOADING THE MOLD-MAKING MACHINE WITH RESIN-SAND MIXTURE
HOT PATTERN PLATE CLAMPED TO MOLD-MAKING MACHINE
INVERTING MACHINE TO DEPOSIT RESIN-SAND MIXTURE ON HOT PATTERN
REMOVING PATTERN PLATE WITH ADHERED SAND-RESIN CRUST
OVEN CURING FRESHLY FORMED MOLD HALF
EJECTION PINS REMOVING CURED MOLD HALF FROM PATTERN PLATE

SHELL MOLDING and Mass Production

It will pay you to ask your foundry department or supplier about the shell molding process, particularly if your plant is set up for long-run production of ferrous and non-ferrous castings.

Shown here is the "heart" of the process – a thin-shell sand mold bonded with BAKELITE Phenolic Resin. The mold is backed with steel shot for reinforcement and heat dissipation as molten metal is poured. Sketches show the steps in mold-making, which can be mechanized.

Here are some advantages that shell molding offers:

- **Metal castings have almost pattern-smooth surfaces.**
- **Pieces are cast to closer finished dimensions—tolerances as close as .003 to .005 inches per inch.**
- **Higher percentage of sound, uniform castings cuts down on rejects.**
- **Metal castings require less machining, reducing production costs.**

Properly applied to your needs, the shell molding process can speed output, lower manufacturing costs and break production bottlenecks. To learn more about it, consult your foundryman. Or if you have a foundry department, write Dept. OM-60 for booklet C-8, which describes shell molding and the BAKELITE Resins developed expressly for it.

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Probably in no other type of part is the economy of powder metallurgy more evident than in high volume production of cams.

Because of the very nature of cam design, the elimination of machining and finishing operations made possible by powdered metal processes can and does result in tremendous production savings. Powdered metal cams produced by Michigan Powdered Metal are uniformly accurate in pitch line radii and in all dimensional tolerances. The materials employed provide the strength and long-wearing qualities required for innumerable cam applications.

The cost-cutting advantages of powdered metal parts can very possibly be applied to your products. The experience and unusual abilities of Michigan Powdered Metal Products Company – one of the pioneers in the field – can help you realize those advantages. Why not investigate what we can offer you by sending your part prints or sample parts to us for quotation.

Write for this bulletin describing our facilities and the scope of our powdered metal parts production.

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LETTERS TO THE EDITOR
continued from page 4

terials and equipment for shell molding, as well as referring us to such a firm or firms, who could give us descriptive literature on various phases of the process.

It is our understanding that some of the suppliers have put out illustrated booklets covering this process. — H. L.

List of suppliers and reference list of some of the literature on the subject have been forwarded. Attention is called to the article, "Shell Molding: What is it? Where is it used?" which appeared in the January 1953 issue of PMM. — Ed.

PRODUCTION ELECTROFORMING

We have read with interest,, the article "Electrodeposition is a production process" in the December 1952 issue of PRECISION METAL MOLDING.

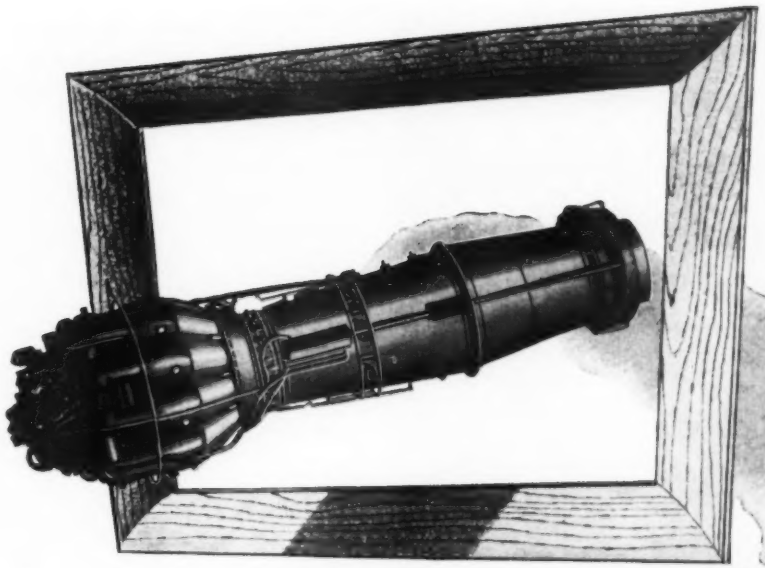
The author, Mr. Harold Rice, indicates in his article that Electroforming is being done on a commercial or production basis. We are interested in investigating the Electroforming process further and would like to obtain the names of commercial producers in this field. We would appreciate any information which you can offer on reliable vendors of Electroformed products. — J. S. M.

Mr. Rice's article has apparently stimulated the thinking of a number of designers and metallurgists who have written for copies of the article, or additional information. Mr. Rice's company, Gar Precision Parts in Stamford, Conn., is a source of contract electroforming on a production basis. Names of sources have been forwarded. — Ed.

DIE CASTING PROCESS STUDY

On page 41 of your December 1952 issue you have an account of "Analytical Study

continued on page 8



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A-6618

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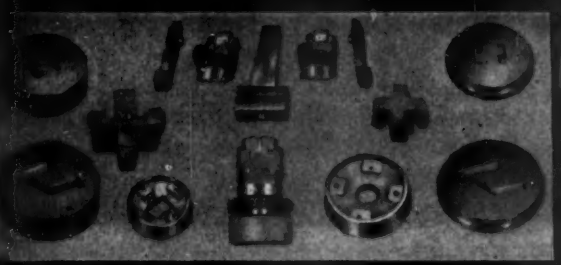

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LETTERS TO THE EDITOR
continued from page 6

of the Die Casting Processes".

We would appreciate your advising us where we can obtain the entire article including the equations mentioned.

— N. P.

Microfilm copy or 6 x 8" enlargements of each page of the entire 91-page manuscript can be obtained from University Microfilms, Ann Arbor, Mich.

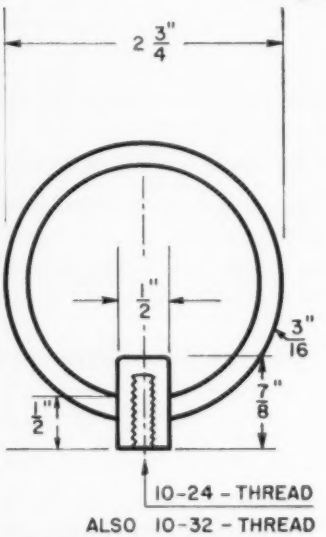
— Ed.

SOURCE FOR DIE CASTING

We are enclosing herewith a sketch of a handle — die cast of zinc alloy metal. We would appreciate if you could advise us the name of manufacturer now producing this article, or anything similar in stock moulds. — L. M.

We do not know the source of this casting, but are submitting the drawing for our readers. Any die caster producing this type of part may wish to contact the company.

— Ed.



SUPPLIERS OF INVESTMENTS

Would you please send us a list of suppliers of investments for ferrous and nonferrous castings, if such a list is available. — L. E. W.

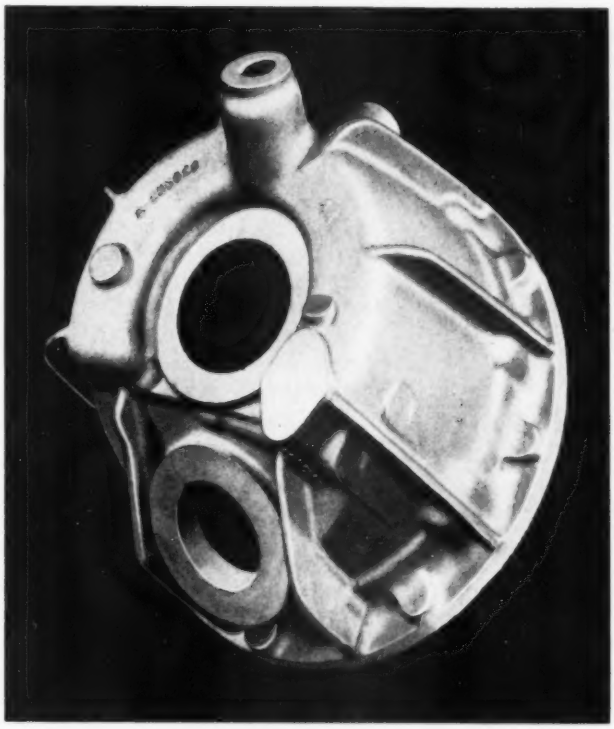
Information forwarded.

— Ed.

continued on page 10

ACME OF CHICAGO

FOR
Quality Light Metal
CASTINGS



TRANSMISSION CASE

For a better light metal engineering service and top quality in your aluminum and magnesium castings, it will pay you to work with ACME of Chicago.

ACME offers a complete casting service for aluminum alloy permanent mold and semi-permanent mold castings and magnesium sand castings.

Whether your problem is a small component weighing a few ounces or a heavy transmission case or other heavy castings weighing hundreds of pounds, ACME'S 32 years of experience can save you time and money, both in the design and the production stages.

This is an example of an Acme magnesium casting. It is the rotor housing for a helicopter. Note that this casting has heavy sections joining comparatively thin sections. Acme produces many castings with these characteristics.

A phone call or letter will bring a competent engineer to work with you on your current problems.

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Then they came to Powdered Metal Products Corporation of America and discovered PMP could supply plugs to the required tolerances and still substantially lower the cost. There was no sacrifice of quality or wear characteristics. In fact the PMP plug withstands repeated tests of over 500,000 cycles—much more than encountered in normal use.

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sign of leadership PMP in powder metallurgy

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LETTERS TO THE EDITOR
continued from page 8

DIE CAST FLANGES

We have, for some time been trying to locate a source of floor type flanges in die cast aluminum, similar to those used for shower curtain rods, etc. These flanges should be suitable for use with ⅝" O. D. and 1" O. D. tubing. — R. J. F.

We will be glad to put any of our readers in contact with reader R. J. F. — Ed.

SIMULATED GOLD PLATE

We are particularly interested in the simulated gold finish over a zinc die casting which you presented in April 1951 as we have a similar application coming up later this year. It would be greatly appreciated if you would forward copies of these articles to our Chicago office. — F. C. C.

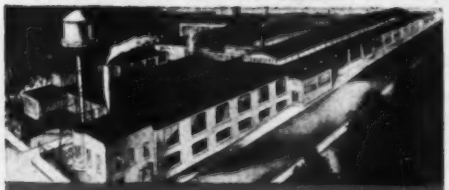
Information and tear sheets forwarded. — Ed.

SMALLEST DIE CASTING MACHINE

I am interested in contacting the or those manufacturers who make the smallest industrial die casting machine. I remember seeing about a small hand operated machine of small capacity in a die book some few years ago, but have no idea who might make a small machine such as I have mentioned.

I am interested in making small castings weighing fractions of an ounce to a pound or more using Zamak for the material. The main reason for my interest in the smallest die casting machine made — one that will give up to a hundred or so castings under the best of conditions per hour — is the factor of cost, which I am assuming is in direct proportion to the size and capacity of all machines. — W. C. P.

Information forwarded.
— Ed.



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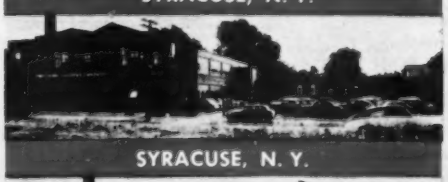

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Here—at ***FORT DIE CASTING,*** production of quality die castings, at lowest cost, is made possible through the completeness of our organization and superb equipment, in our fully modern 100,000 square foot plant.

ENGINEERING: We maintain a competent Engineering Department to assure good casting design, the proper types of metals and methods to be used, and for close co-operation with our clients.

TOOL and DIE: We maintain complete tool and die making facilities. In this department, staffed by skilled technicians, we are equipped to completely tool up for your program and manufacture the dies to meet your specifications.

DIE CASTING: We maintain large batteries of modern die casting machines to meet all size requirements, plus special machines for die casting aluminum and lead. Expert metallurgical control is assured for the proper choice of alloys.

MACHINING: We maintain an unusually complete Machining Department. For these important and cost-saving operations, we design and manufacture new labor-saving jigs and fixtures for use in our large batteries of presses and other machining equipment, and when necessary, we design and build special purpose machines.

PLATING and FINISHING: We maintain complete facilities for mechanical finishes such as, burnishing, buffing and polishing; plating and finishing processes such as, chemical treatments, electrolytic coatings and painting.

Yes—you'll get ***Action*** with ***Accuracy,*** from ***Start*** to ***Finish*** at **FORT**—and insure the proper and most economical production for your die cast products. We invite your inquiries.

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FORT DIE CASTING CORP.

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Between The Lines

in this and coming issues of PMM

• TRADE ASSOCIATIONS play an important part in the life of any industry through their deliberations on common problems and their dissemination of information about their industry. Important news of activities of three such groups can be found in this issue: beginning of a new investment casting organization is covered on page 45, while announcement of the Ninth Annual Meeting of the Metal Powder Association appears on page 49. Also, abstracts of three important papers delivered before a meeting of the Magnesium Association begin on page 36.

• POWER TRANSMISSION is a factor that enters into the design of every machine, whether it is a domestic appliance, a business machine, a special-purpose unit or a military device. One article touches on the subject in this issue. How Bendix Home Appliances use a die cast sprocket and driving unit in the transmission for their washing machine is described on page 38.

• ANOTHER UNIVERSAL factor in machine design is that relating to cams. Very often sinterings can serve for cams because it is possible to hold accurate contours over a large production run. Some of the types of sintered cams and their service characteristics are explained on page 32.

• MOVING PARTS of die casting dies have to be made with close working tolerances and also have to operate at elevated temperatures. This presents the die designer a difficult problem in lubrication of cores, slides and ejectors. A British authority on die casting writes of his ideas and designs for improved die lubrication in an article beginning on page 86.

A FEW OF THE THOUSANDS OF SMALL DIE CASTING PARTS WHICH HAVE BEEN MADE MORE ECONOMICALLY THAN ON ANY OTHER EQUIPMENT.

SHOWER TEMPERATURE CONTROL

CAR WINDOW REGULATOR HANDLE

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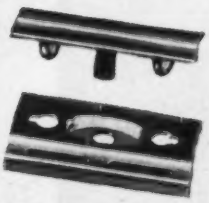

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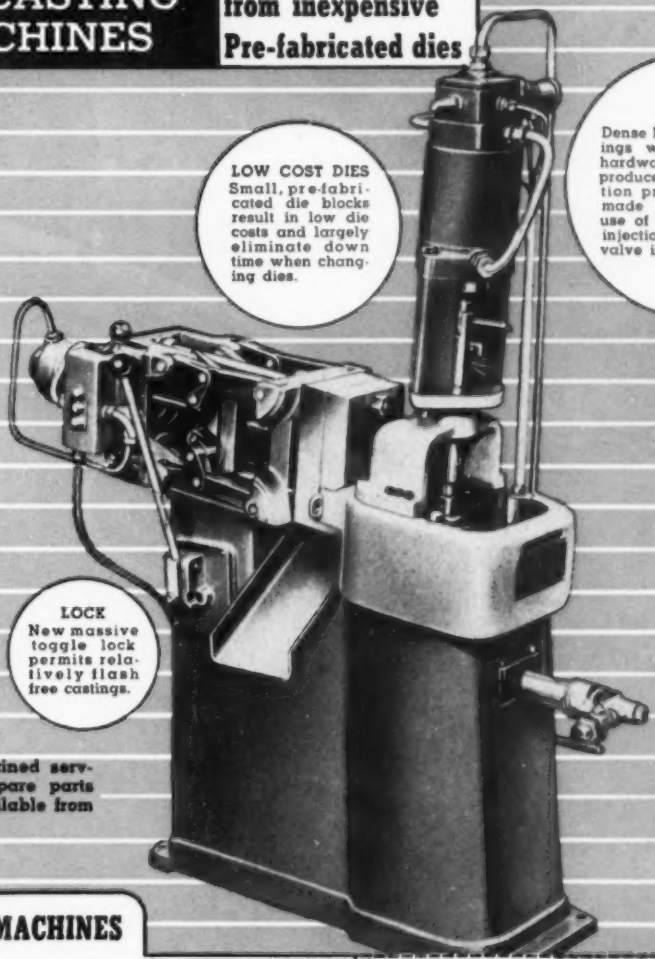
800 SHOTS per hour from inexpensive Pre-fabricated dies



LOW COST DIES Small, pre-fabricated die blocks result in low die costs and largely eliminate down time when changing dies.

FINISH Dense homogeneous castings with high quality hardware type finish are produced by higher injection pressures. This is made possible through use of new impact type injection and patented valve in head.

LOCK New massive toggle lock permits relatively flash free castings.

Factory trained service and spare parts stocks available from New York.

SERVICE Our field engineers are available to offer complete engineering and die design service. Furthermore, we will design your first die free of charge if you so desire.

DCMT DIE CASTING MACHINES

Low cost, high efficiency, small die casting machines, which have won the acclaim of engineers throughout the world. DCMT machines produce precision die castings at high speeds with remarkably low operating costs! Dies are small, inexpensive, readily interchangeable. Non-productive time reduced to a minimum!

Model	IMP 96	ADC56	M55A/HF
Size of Die Plates	6 x 9	6 x 5	6 x 5
Size of Die Plates Max.	9 x 9	8 x 6	8 x 5
Toggle Die Locking Pressure	12 tons	6 tons	6 tons
Capacity in Ounces	16	2½	12
Std. Dia. of Plunger	1½"	1"	1.200"
Floor Space	30" x 12"	35" x 12"	30" x 12"
Net Weight—Lbs.	450	250	400

DELIVERY 30 DAYS OR LESS

Complimentary Catalog

DCMT SALES CORP. DEPT. PM-2
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- ☐ Complete details, current prices and all pertinent specifications are included in the new DCMT catalog.
- ☐ Please arrange for me to see a DCMT Die Casting Machine in operation in my locality.
- ☐ I am enclosing sample or drawing for free cost analysis as produced on DCMT machines.

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Do you use parts like any of these*?

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Most of these parts were purchased by leading manufacturers . . . experts at getting the "best buy". Do you see one that resembles a part you use now, or need? If you do, why not check with us for possible savings? Send prints or samples for estimates and engineering advice, at no obligation. Or, write for our General Facilities and/or Small Parts Bulletins.

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we have to know what we're doing!

METAL POWDER PARTS BY MORAINE

For more than a quarter of a century we've been successfully making metal powder parts . . . *billions* of them . . . because we have that vital commodity—a combination of knowledge and experience called *know-how.*

Our metal powder parts are doing more and better jobs for industry every day and we offer our customers an ever widening choice of materials for ever broader applications. Moraine parts have close tolerances, improved physical properties, and are produced in ever more complicated designs.

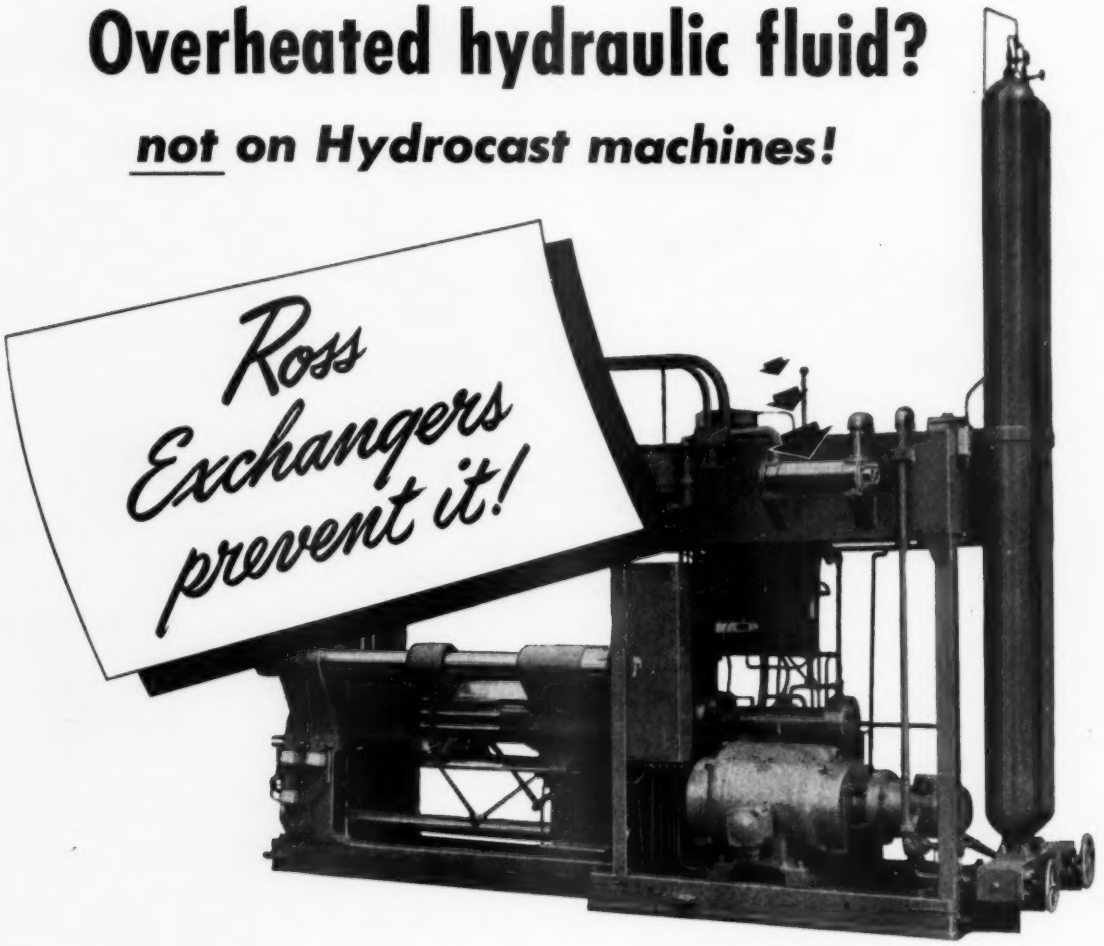
New customers for parts that can be produced practically by the powder metallurgy process are still being considered by Moraine. Volume must be sufficient to justify tooling so that benefits can be shared mutually.

moraine products

DIVISION OF GENERAL MOTORS CORPORATION • DAYTON, OHIO

Overheated hydraulic fluid?

not on Hydrocast machines!



Small, compact and often unnoticed because they require so little attention, the Ross Exchangers on Hydrocast Cold Chamber Die Casting Machines nevertheless have a *big* responsibility. They put hydraulic fluid temperature in its place *and keep it there!*

Pump slippage from thinned, overheated oil — robbing essential hydraulic power — doesn't get the chance to happen. Temperatures are kept within prescribed limits.

Hydropress, Inc., New York, designer and builder of Hydrocast machines, puts it this way: "We find that Ross Exchangers meet the requirements of our equipment quite adequately and they are working trouble-free." That applies not only to die casting equipment, but to other types of Hydropress machines as well: extrusion presses, pipe testing machines, combined belling, expanding and testing machines, for example.

Whether you build or buy hydraulic machinery of any description, you will find it much to your advantage to know more about fully standardized, all-copper and copper alloy Ross Type BCF Exchangers. Bulletin 1.1K5 will bring this information to your desk. Write.

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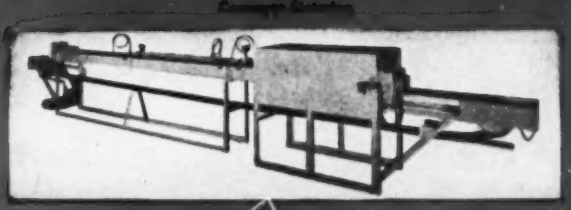
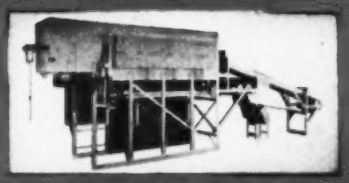
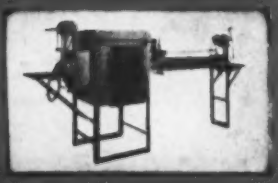
Metal Powders

"A compact is only as good as its sintering!"

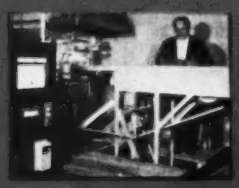


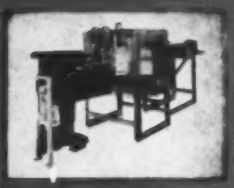
Combination Sintering and Hardening, Conveyor



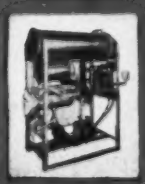


Combination Sintering and Hardening, reciprocating hearth and conveyor





Exothermic Atmosphere Generator



Tank Hydrogen Atmosphere

Endothermic Atmosphere Generator

THESE ARE THE TOOLS FOR SINTERING AND HARDENING METAL POWDERS

For your SINTERING have the BEST equipment

Cash in on Hayes know-how and experience in *solving* sintering problems. *Freely* use our extensive laboratory facilities. *Correct* furnace design and atmosphere control *vital* in producing *quality* powder metal parts. Hayes' electric furnace design, backed by 46 years experience, *assures:*

- — absolute production control over time, temperature and atmosphere in both sintering and hardening.
- — highest degree of uniformity throughout the production cycle.
- — scale-free, clean or bright sintering and hardening.
- — retained properties of color and carbon content (can increase carbon content if desired).
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You receive the maximum in quality and economy of production because of the years of experience Hayes has had in customers' plants, and because by our Laboratory facilities we PROVE BEFORE PURCHASE the superior results you will get. Standard or special — we study your needs and give you EXACTLY the furnace and atmosphere equipment to assure you the fullest advantages of modern powder metallurgy.

"Large volume at low cost", Andy Wayson, Merriman Bros.

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"Laboratory facilities, WITHOUT CHARGE", Carl Hayes, C. I. Hayes, Inc.

For complete details of this equipment request latest catalog

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Specify DME *Precision Built* **STANDARDS**

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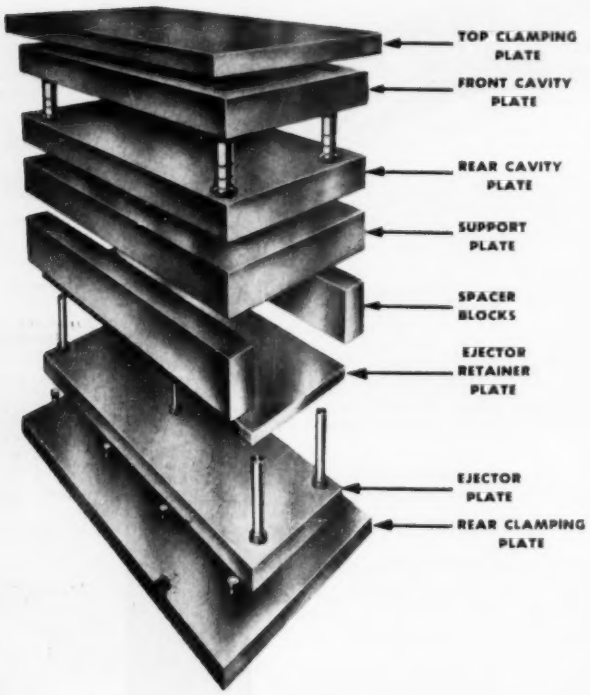

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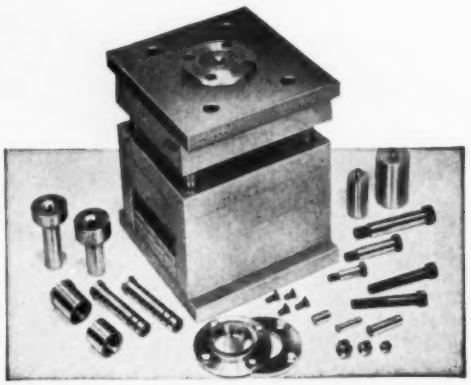

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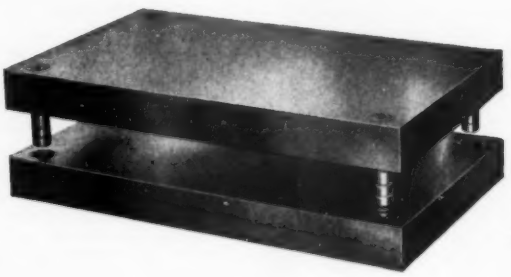

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17 STANDARD SIZES from 8" x 9" to 18" x 35½" !

CAVITY PLATES from 7/8" to 5⅞" THICK — CARBON OR ALLOY STEEL

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BASTIAN-BLESSING
PRESSURE REGULATORS USE PARKER *Die Castings . . .*

Less than 3% *rejection on final* PRESSURE TESTS!

THE BASTIAN-BLESSING COMPANY manufactures the "RegO" line of liquefied petroleum gas equipment. To the LP-Gas industry "RegO" has become the symbol of quality—the assurance of a complete and satisfying service. The heart of the LP-Gas installation is the pressure reducing regulator—upon its accurate and reliable performance the entire system is dependant. Parker Die Castings were selected because they reduced machining costs to a minimum. On final tests, less than 3% of the castings were rejected—97% met the rigid requirements of tolerance and strength under high pressure. This is another instance when Parker Die Castings are serving industry. Parker Die Castings are economical. You can profit from Parker experience in designing and producing quality die castings for a variety of industrial and commercial applications. Consult with Parker on your next die casting requirements. The result will be mutually profitable.

and when you think of Die Castings THINK OF

Parker White-Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER ALUMINUM *and* ZINC *Die Castings*

For additional information Circle No. 26 on the Reader Service Card

1 **DIE CASTING** is the Process...

number 2 of a series **ZINC,** the Metal...

3 **BUNKER HILL,** the *Preferred* Zinc

ZINC ALLOYS are used to the extent of approximately 60% by weight of all die cast parts consumed annually in the United States, largely because of economies resulting from the ease and speed with which they can be cast. The low casting temperature (750 to 800°F) of these alloys results in low fuel cost, low die cost, and low die maintenance. The castings are dimensionally stable, have excellent mechanical properties and can be economically polished, plated, painted, or finished by other processes. Zinc alloys also have high fluidity at casting temperatures. Die castings of highly complex design needing little or no machining can thus be readily produced.

The ability to cast zinc alloys of remarkable smoothness keeps finishing requirements to a minimum. Frequently, only buffing is necessary prior to plating in brass, nickel or chromium, or for the application of other types of finishes. This is a primary reason for using zinc base die castings almost exclusively for hardware and decorative applications, especially in automobiles and countless other consumer products. The production of the most intricate zinc alloy castings has become an everyday job.

Today, die castings based on zinc are a vital factor in modern engineering processing, and their range of applications is constantly being broadened as industry comes to appreciate the advantages and the extent of the economies that zinc base die castings yield.

Eastern Sales Agents: **ST. JOSEPH LEAD CO., 250 PARK AVE., NEW YORK 17**

BUNKER HILL 99.99+% ZINC

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You're always right with AUTO-LITE Die Castings

● Many of America's leading manufacturers, producing a wide variety of products, are benefiting from Auto-Lite die cast research, experience and advancement. Such developments as high pressure casting, special alloying practices and improved quality through the "controlled metals process" make Auto-Lite the logical source of supply for precision die castings. Address inquiries to:

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DIE CASTINGS • WIRE & CABLE • PLASTICS • INDUSTRIAL THERMOMETERS

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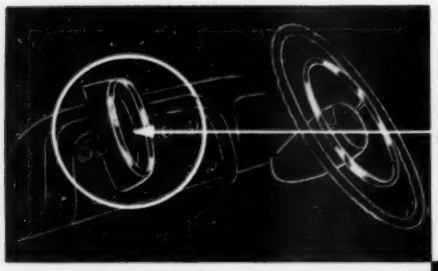

426 MPH*

in a CLEVELAND die casting machine!

* That's the actual figure, but the abbreviation stands for units *made* per hour — in the Cleveland Die Casting Machine shown at right. Working in the ultra-efficient King-Seeley plant at Scio, Michigan, this Cleveland machine is speeding production of automobile dashboard instrument parts. The part being produced, an instrument cluster housing, is shown below, "as cast."

King-Seeley uses zinc die castings extensively for such parts as the horn ring shown below; housings for telegages (water temperature, fuel level and oil pressure); bezels; small intricate frames; and speedometer and gauge components. Chances are your car has several King-Seeley products in it.

King-Seeley Corporation, leading supplier of dashboard instruments to major automobile manufacturers, is widely known for excellence of product design and construction; for high efficiency in manufacturing methods. To maintain critical standards in its die casting department, King-Seeley relies on a Model 400 Cleveland to produce top quality castings at high speeds.

Typical of the parts produced on this Cleveland machine is the instrument cluster housing shown above. Approximately six pounds of zinc alloy are injected into the die, producing two parts per shot. The Cleveland's powerful die locking pressure and high injection speed produce sound, dense, *"hardware finish"* castings. Dimensions are held to close tolerances. Secondary drilling operations on the part have been eliminated by precision coring of 13 holes. Production averages 213 shots—426 parts —made per hour.

To get the *most* from *your* die casting department—in speed of production and quality of casting—profit from the experience of leading die casters and investigate the advantages of the Model 400 Cleveland. Your inquiries will receive prompt attention. For machine specifications, write for free copy of bulletin.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
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SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

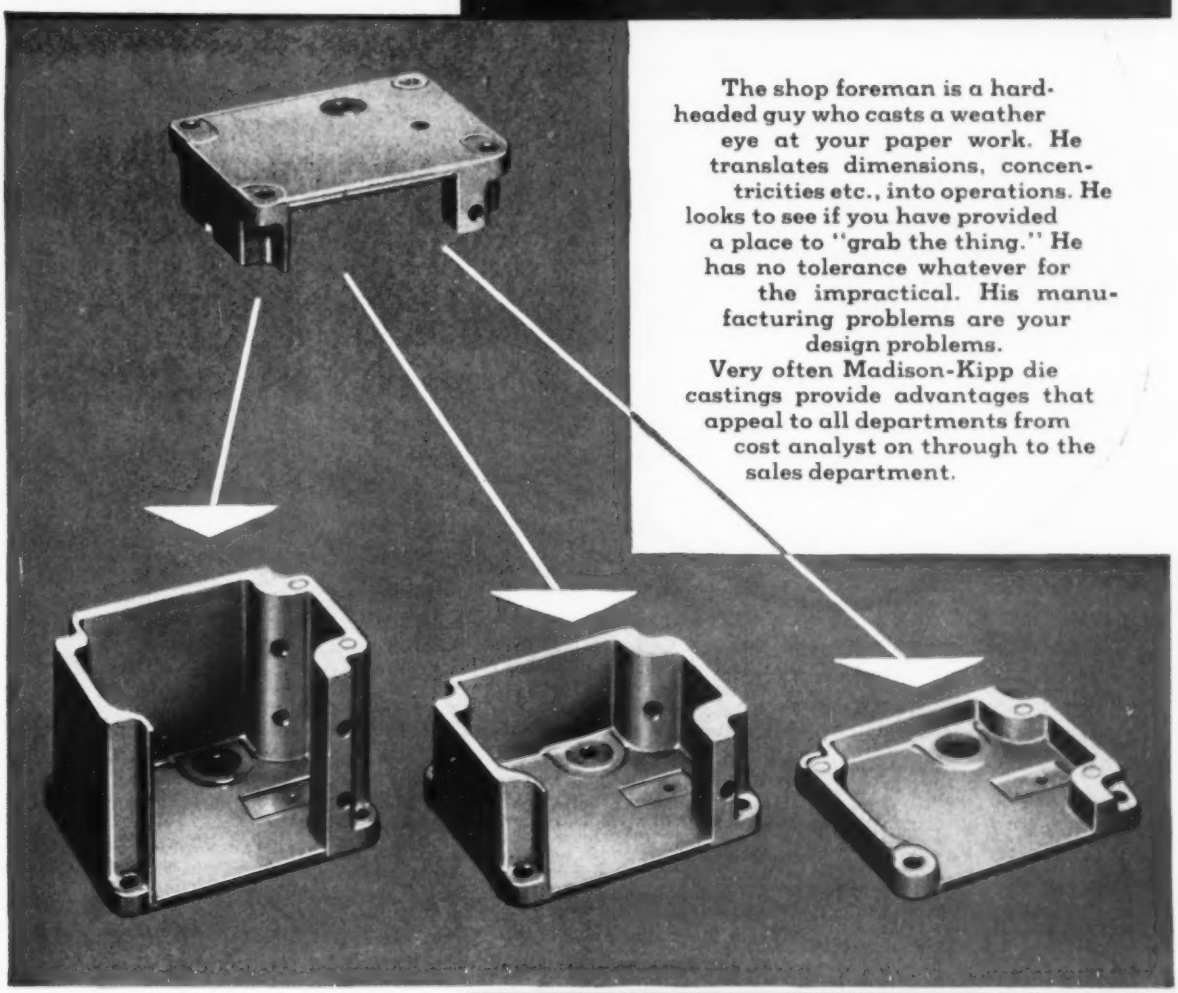
For additional information Circle No. 9 on the Reader Service Card

A MASTER DESIGN *formula:*

To have your new design meet the approval of your shop foreman as well as the boss — because foremen know most about the practical side of your manufacturing equipment and personnel.

MADISON-KIPP ZINC AND ALUMINUM DIE CASTINGS

OFTEN PREFERRED BY DESIGNERS, MANAGERS, AND FOREMEN



The shop foreman is a hard-headed guy who casts a weather eye at your paper work. He translates dimensions, concentricities etc., into operations. He looks to see if you have provided a place to "grab the thing." He has no tolerance whatever for the impractical. His manufacturing problems are your design problems.

Very often Madison-Kipp die castings provide advantages that appeal to all departments from cost analyst on through to the sales department.

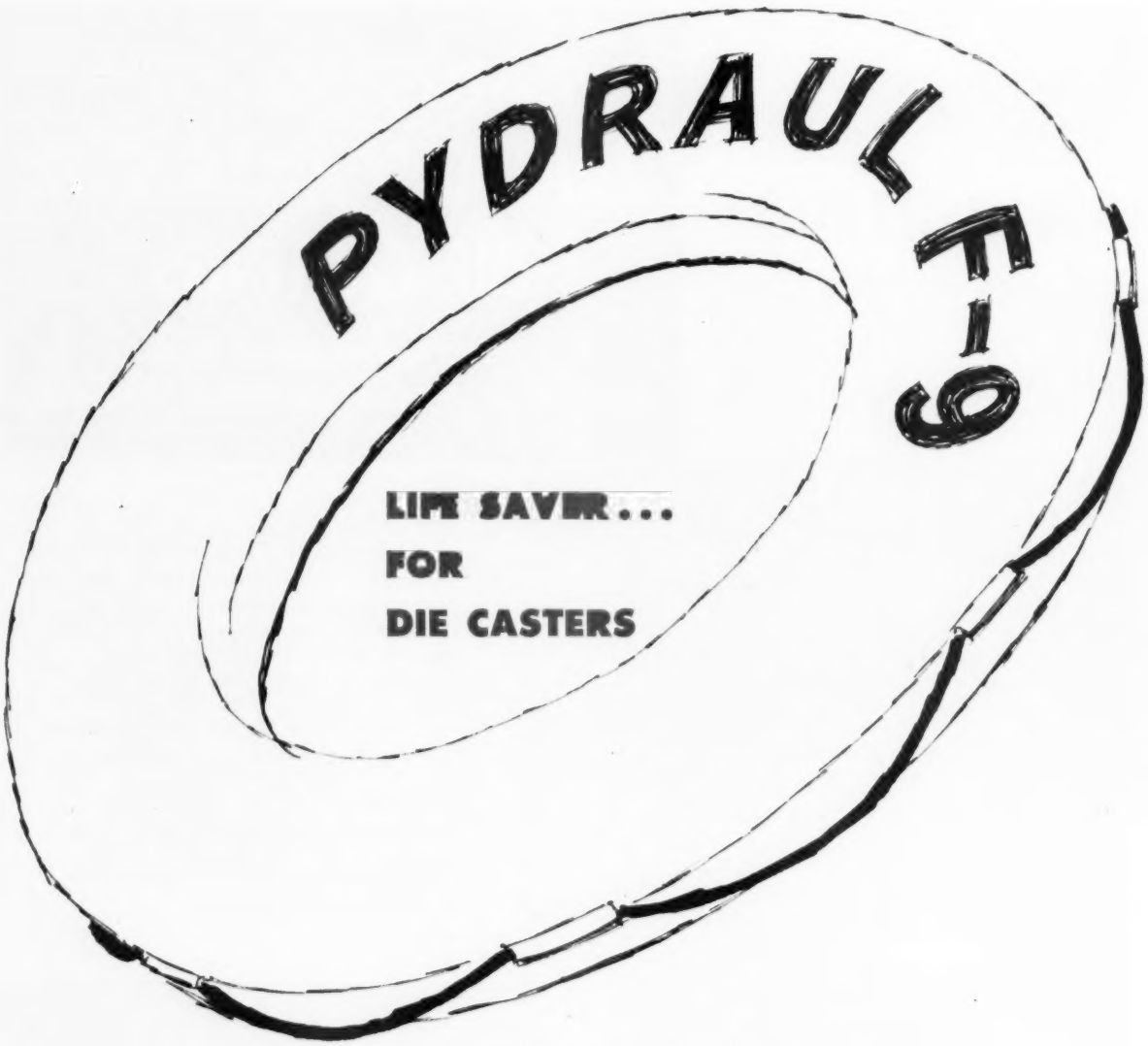
3 different instruments with 4 Madison-Kipp Die Castings — each with a special bearing insert — each casting with matching countours, locating points and centers, made for MICRO, Makers of Precision Switches, Freeport, Illinois.

MADISON-KIPP CORPORATION

213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• **Skilled in Die Casting Mechanics** • **Experienced in Lubrication Engineering** • **Originators of Really High Speed Air Tools**

For additional information Circle No. 23 on the Reader Service Card



When a discharge line parted recently on a West Coast die-casting machine, the hydraulic fluid—Monsanto's Pydraul F-9—sprayed into a hot zinc melting pot, drenched the machine operator and splattered several onlookers. Result: no fire, no injuries, no production loss.

Without *fire-resistant* Pydraul, the story would have been tragically different. Millions of dollars are lost each year in fires caused by escaping hydraulic fluid.

Why risk losing your plant in a fire of this kind? Under test, Pydraul will not flash or ignite even when poured on molten metal or sprayed into an oxyacetylene flame. Can you say the same about the fluid now in your hydraulic lines?

If not, then drain it out and put Pydraul in. No equipment changes are necessary.

Pydraul Reg. U. S. Pat. Off.

Our specialists will help. Call the Monsanto office near you. Meanwhile, write us for "Pydraul F-9," an informative engineering report. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Mo.

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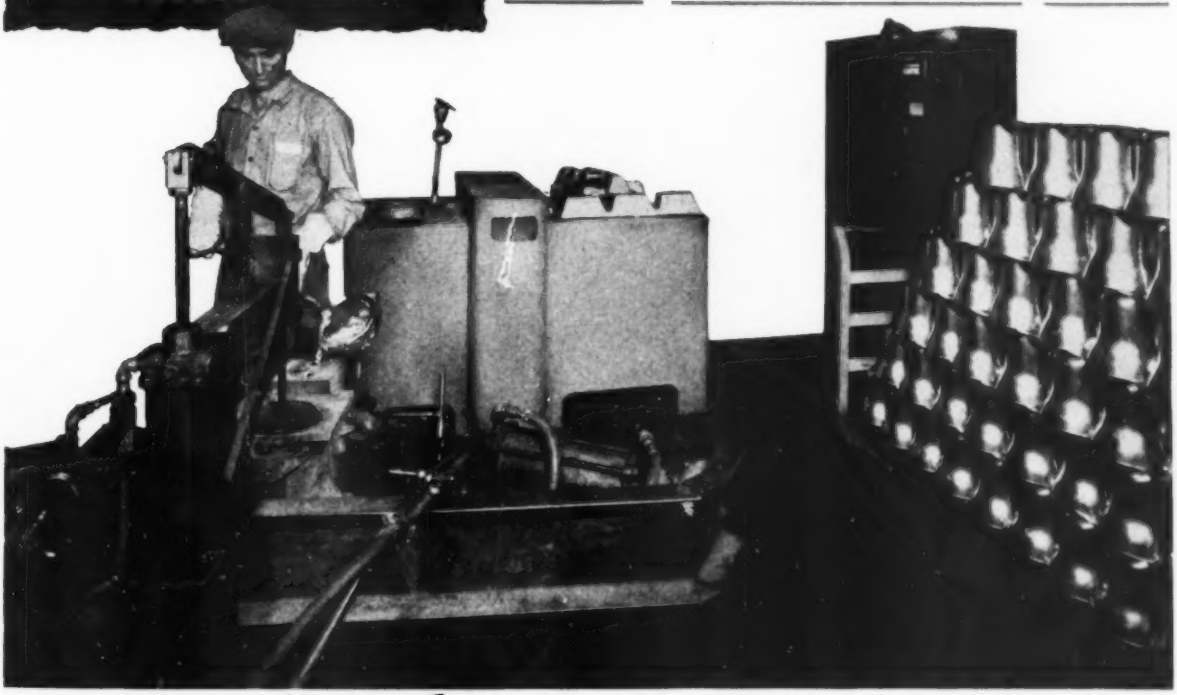
CHEMICALS for PLASTICS

Serving Industry . . . Which Serves Mankind

For additional information Circle No. 34 on the Reader Service Card

IN-SINK-ERATOR *increases production 50%... cuts rejects 33%*



WITH *LINDBERG-Fisher* 2-CHAMBER MELTING FURNACE

In-Sink-Erator Mfg. Co., Racine, Wisconsin, manufacturers of the nationally known In-Sink-Erator Food Waste Disposer, are increasing production, and improving product quality with a Lindberg-Fisher 2-chamber Induction Melting Furnace. The furnace, a 50 KW unit, is used to melt aluminum prior to casting into container housings for the In-Sink-Erator.

Here's what E. E. Wieczorek, works manager, has to say about his Lindberg-Fisher:

"This new melting furnace is really doing a job for us. With it, we've been able to increase production 50% and cut mold maintenance in half. And our rejects are down to less than 3% . . . a 33% reduction from rejects with the old crucible melting furnaces. Speaking of crucible furnaces brings up another point . . . since replacing our crucible furnaces with the Lindberg-Fisher Induction Furnace our labor turnover in the Molding Dept. has been stopped flat."

Check these
LINDBERG-Fisher advantages!

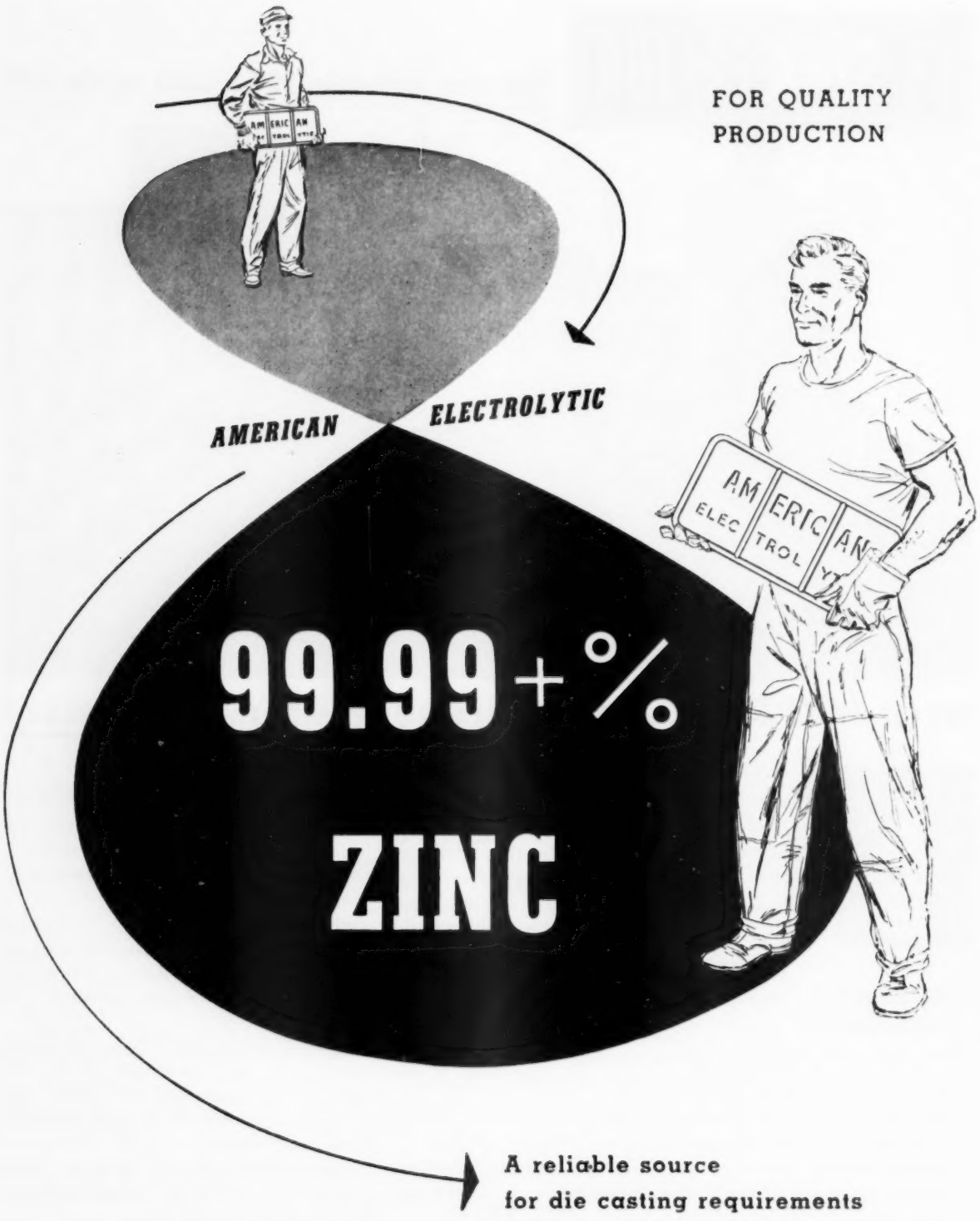
- **CLEANER MOLTEN METAL** . . . Residue and impurities remain in charging chamber . . . only clean, residue-free metal passes to ladling chamber.
- **CONTINUOUS LADLING** . . . 2-chamber design allows cold metal to be added to charging chamber without affecting temperature of ladling chamber within operating limits of furnace.
- **COOLER OPERATION** . . . Induction heating heats only the metal, not the entire furnace. No flame . . . no products of combustion. Only comparatively small area of molten aluminum is exposed to operator.
- **LESS MAINTENANCE** . . . Refractory-lined chambers . . . no crucibles or pots to replace. No burners to replace or adjust.

For detailed information ask for Bulletin 560, "Lindberg-Fisher Two-Chamber Induction Melting Furnaces"

LINDBERG-Fisher MELTING FURNACES

Lindberg Engineering Company, 2463 W. Hubbard Street, Chicago, Illinois.

For additional information Circle No. 22 on the Reader Service Card



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Distributors for

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For additional information Circle No. 5 on the Reader Service Card

"Very pleased" with Mount Vernon Die Casting

CASE HISTORIES FROM MT. VERNON FILES

The tools shown here are Porter-Cable Machine Co's. Model 503 Sander and Model 511 Router.

Says Porter-Cable: "All of the castings for our No. 503 Sander and No. 511 Router are made by Mount Vernon Die Casting Corporation, and we are very pleased with the work done for us by this die-caster. The main frame on the sander required an especially difficult die, and Mount Vernon did an excellent job.

We find that die casting the parts which house our portable tools enables us to—

(1) hold down weight to a minimum;

(2) lower cost of tooling—since die casting can be held to such close tolerances that many machine operations can be eliminated;

(3) get high quality castings at reduced costs;

(4) obtain faster deliveries—permitting us to step up our own production schedules."

Here are compelling reasons why die casting merits serious consideration by every manufacturer with a metal product in the blueprint stage.

If you'll send us your specifications, we'll gladly put our long experience and specialized knowledge at your disposal . . . go to work to **please you in every respect,** just as we have pleased Porter-Cable.

MT. VERNON
DIE CASTING CORP.
MT. VERNON, NEW YORK

For additional information Circle No. 25 on the Reader Service Card

SCHULTZ

Specialists in Zinc Die Casting

■ *YOU REQUIRE* die castings competitively priced which are dimensionallly accurate and superior in surface finish, delivered in time to meet your production requirements.

■ *WE FURNISH* zinc die castings of the highest quality delivered in accordance with shipping schedules at prices which are most attractive. For nearly a quarter of a century we have served many of the nation's leading manufacturers in this manner. May we also have the pleasure of serving you?

Exclusively Zinc Die Castings

SCHULTZ DIE CASTING COMPANY

1810 CLINTON STREET • TOLEDO 7, OHIO

For additional information Circle No. 29 on the Reader Service Card

aircraft component steel parts made from ACCUMET PRECISION INVESTMENT CASTINGS

The pictured castings are currently being used to produce such important aircraft accessories as fuel injectors and regulators, carburetors, landing gear door latch mechanisms, rocket release mechanisms and radar equipment. Cast to close tolerances with smooth surface finish, expensive machining operations are avoided—resulting in saving of valuable time, reduction in cost and eliminating the need for hard-to-get machine tools. Also *Accumet Precision Investment Castings* permit the use of higher alloyed steels that are difficult or impossible to machine or forge, thus increasing the life or performance of the component parts.

ENGINEERING SERVICE AVAILABLE

Crucible engineers and metallurgists are available to assist you in solving your design or production problems by the application of these Accumet Precision Investment Castings . . . that are playing such an important part in our National Defense Program.

CRUCIBLE

first name in special purpose steels

52 years of Fine steelmaking

ACCUMET PRECISION CASTINGS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

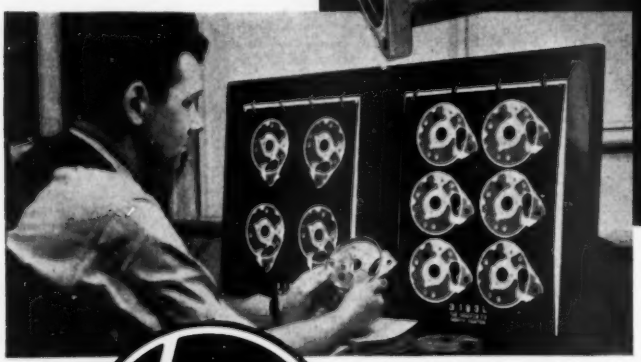
For additional information Circle No. 10 on the Reader Service Card

Manufacturer of steel-cutting shears cuts labor costs 19%—material costs 41% with

Die Castings by Hoover

Right
These castings for a well-known make of steel-cutting shears are notable for their intricate design and precision fit. After absorbing the die costs, the manufacturer expects the direct savings of having these parts die cast by Hoover to return at least 20% a year on his company's investment.

Below
Hoover's facilities include the latest equipment for spectography, fluoroscopy and X-ray to determine the right alloys and casting techniques to eliminate rejects and to assure strength of the finished casting.



HOOVER

Call in a Hoover Engineer to see how Die Castings in aluminum or zinc can help you cut costs and increase production through

- **Reduction in number of parts**
- **Saving in time, labor and material**
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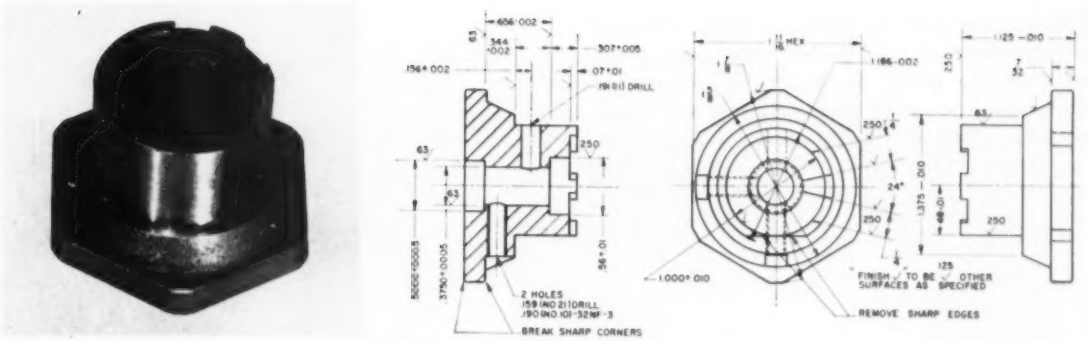


MORE THAN a half hour of machine time would be required to finish this knob on conventional machine tools. This is a place where investment casting is the answer to overwhelming secondary costs.

High cost of machine tools avoided by INVESTMENT CASTINGS

IN the manufacture of the T-41 range finder, the Otis Elevator Co. of Yonker, N. Y. has found that many parts specified as forgings or fully machined units could be investment cast at a considerable saving. Typical of the parts where conversion has been made is the knob illustrated which is being cast in corrosion resistant steel by the Arwood Precision Casting Co. of Brooklyn, N. Y.

For this part, both dimensional accuracy and finish are important. As an investment casting both of these critical features are met even though some of the dimensioning approaches the limit of possibility of the investment casting process. For example, both the top and bottom surfaces are counterbored and the distance between the faces of the counterbores must be held to a total variation of -0.002 in a length of 0.656. As can be seen from the drawing there are several other dimensions where the tolerance is of the same order as that noted above. Despite this extreme closeness (that is, close for the process) uniform production is maintained.

As noted above, surface finish is important. The finest finish required is 63 micro-inches RMS, well within the normal finish of an investment casting.

While the accuracy and finish achieved are impressive and an over-all cost reduction of some 15 percent is achieved by far the most important feature to Otis is the saving realized by not having to purchase new machine tools, notably milling machines.

Based upon operation of the plant on one eight hour shift per day and a production of 320 complete units per month a milling time of one-half hour per unit will consume the total time of one machine. Since the milling time per knob, of the type illustrated, is greater than 30 minutes more than one machine would have to be purchased. Since these mills cost in excess of $9,000.00 each there is an immediate saving to the company of at least that much at the very start by investment casting the knob.

Including the part shown there are about nine different investment castings that go into the range finder and each one of them represents this same double saving — first a saving in machine tools and second a saving in direct manufacturing cost.

FEW types of machine parts are better adapted for reproduction by powder metallurgy methods than are cams. Some of the factors that bear upon the use of sintered cams are: costs, service conditions, shapes, accuracy and quantities. These factors are discussed below.

How service conditions and costs affect design of SINTERED CAMS

By G. L. BACHNER*

THE use of powder metallurgy as a fabricating method for the production of cams opens a new field to the design man. With this technique, new materials are available and many shapes that are far too costly to machine can be made easily and inexpensively in both standard and special materials.

Many machines, of which business and vending machines are prime examples, require a multiplicity of motions that can only be achieved through the use of complex cams, located in many instances, where adequate lubrication is virtually impossible. Wear on these parts is always severe and were it not for the ability of sinterings to be permanently lubricated, the maintenance of many machines would be tremendously increased.

Even the limitation that a sintering could not be used under conditions of severe impact is no longer true since the development of commercial infiltration methods. What then are the available materials and production procedures by which sintered cams can be made. The functional characteristics will, to a large degree, determine both the method of manufacture and the material. For this reason, the following discussion will be divided according to use.

Low cost cams for light service

In this category fall many of the parts going into low cost, light duty machinery. The cams are lightly loaded and in most instances can be adequately lubricated by any one of several different methods. As a sintering, such cams can be made of iron powder where no special corrosion resistance is required or of copper, brass, bronze, nickel silver, stainless steel, etc., where specific corrosion resistance is needed.

As a rule, such cams are made with an initial porosity of from 15 to 25 percent and are impregnated with oil. If the shape is relatively simple so that die costs are not excessive, the cost of the finished cams is relatively low and in most cases is far below the cost of a comparable part machined from bar stock or from a sand casting.

As the shape becomes more complex, the cost of the tooling increases (this would be true of any method of production) and the unit cost of the cam will increase. Generally, however, even very complex shapes can be produced more economically as sinterings than by other fabricating methods.

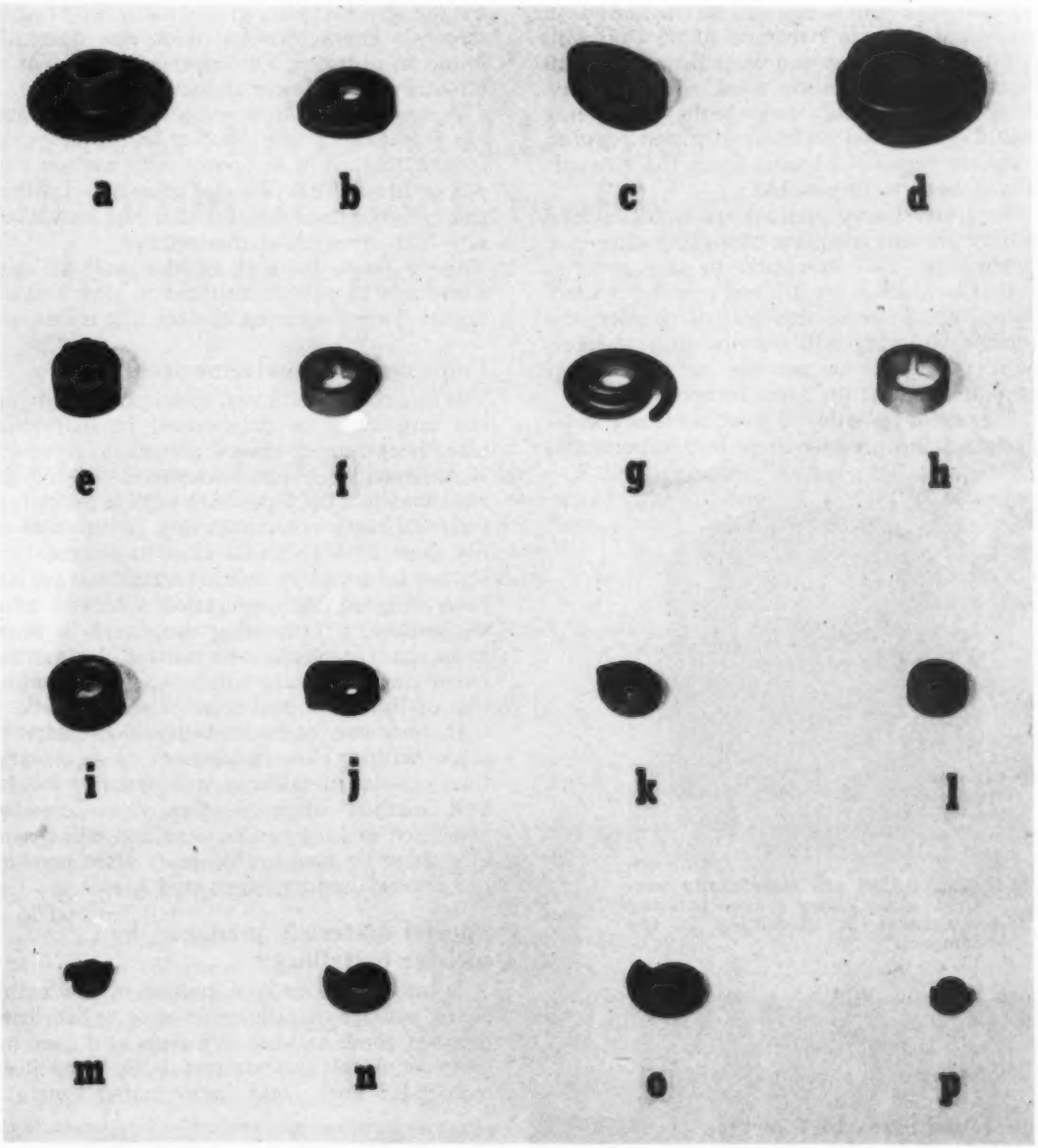
Low cost cams for heavier duty service, no impact

In this group come those cams where the loading on the camming surface is heavier. Generally, only iron powder is used for this type of part since it is necessary to harden after fabricating. The sintering can be case

continued on page 34

*President, Powdered Metal Products Corp. of America.

Many types of cams are successfully made by powder metallurgy.



a., TV antenna rotor, iron powder, rustproofed, final density 6.0; b. Business machine, iron powder, rustproofed, final density 6.6; c., Air conditioning unit, iron powder, rustproofed, final density 6.6; d., Business machine, iron powder, rustproofed, final density 6.6; e., Washing machine timer, iron powder, rustproofed, final density 6.6; f., Magneto, iron powder, oil impregnated, final density 6.0; g., TV antenna rotor, iron powder, rustproofed, final density 6.0; h., Magneto, iron powder, oil impregnated, final density 6.0; i., Magneto, iron powder, oil impregnated, final density 6.0; j., Business machine, brass powder, oil impregnated, final density 6.8; k., Business machine, brass powder, oil impregnated, final density 6.8; l., Business machine, brass powder, oil impregnated, final density 6.8; m., Water heater timer, iron powder, oil impregnated, final density 6.6; n., Washing machine timer, iron powder, rustproofed, final density 6.0; o., Washing machine timer, iron powder, rustproofed, final density 6.0; p., Water heater timer, iron powder, oil impregnated, final density 6.6.

carburized as a final treatment to almost any desired depth.

Hardness as quenched will be file hard with maximum particle hardness of 65 Rockwell C. Surface hardness and wear properties will depend upon procedures used, with the draw being very critical. Salt bath carburizing should be avoided on non-infiltrated parts as complete removal of salts from the sub-surface is next to impossible.

Generally heavy sections are to be avoided as they prevent adequate hardening after case carburizing. The exception to this generalization is when a pre-alloyed powder is used. Through the use of this sort of powder, the finished sintering will respond to heat treatment in the same manner as a piece of wrought stock of the same composition.

The use of pre-alloyed powders is not widespread at the present time, but is becoming more common. While a wide variety of pre-alloyed powders is currently available, the designer should consult a fabricator before specifying any of these materials.

SIDE-CAMS are occasionally possible, using either special pressing equipment or machining in the compact.

Cams for heavy duty service including severe impact

Two developments in the powder metallurgy field have made possible the use of sinterings where heavy stresses, including impact stresses, are normally encountered. These methods are the pressing of iron powder to full density so that the final part has all of the physical properties of wrought material. This technique is considerably more expensive than normal powder metallurgical processing, but for small parts, can often be used to marked advantage.

In many cases, a small amount of copper, up to 10 or 15 percent, is added to the iron powder and the part sintered above the melting point of the copper. The small amount of liquid phase present acts as bonding material for the iron particles, giving materially higher strength characteristics than are normally found in sintering. Oil impregnation is not as effective as in lower density parts.

A second technique involves making a porous sintering of iron powder and as a second step, filling all of the pores with molten copper or brass. This process, known as infiltration, gives a final product that has exceptionally high strength characteristics.

Parts made by both of the methods just noted can be case carburized to give a much higher, longer-wearing surface if it is desired.

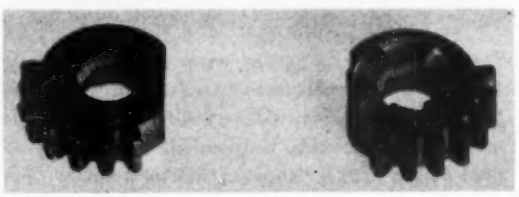
Cams requiring extreme accuracy

While the quotation of tolerances is dangerous and must be determined in individual cases if extremely close dimensional accuracy is required, it is not uncommon to hold dimensions to 0.0005 per inch with a maximum total indicator run-out at any given point of not over 0.0005. These close tolerances are always achieved by coining after the cam has been sintered. This operation increases tooling costs and processing costs and in some cases, has precluded the use of a sintering when final costs are compared with production of the same part from wrought stock.

If, however, reproducibility from piece to piece within close tolerances is necessary, then powder metallurgy will probably be the best method of production since dies of cemented carbide can be used and will normally show no measurable wear after producing several hundred thousand pieces.

Special materials produced by powder metallurgy

Because of its unique method of producing parts, powder metallurgy is able to fabricate unusual combinations of metals and combinations of metals and non-metals. Some of these materials are: oil impregnated metals, cemented carbides, metal-graphite mixtures, metal-metal oxide mixtures and some others. With the exception of the oil impregnated materials, all of these are infrequently used as cam materials, but for special cases, can readily be fabricated.



COMBINING differences in section with a gear, this piece illustrates potentialities of face cams.

PERMANENT MOLD CASTINGS in hand-held, book molds for low temperature alloys

THE principle of operation and, for that matter, the design of gas meters has changed very little in the past one hundred years. In the 1850's and today the measurement and recording of gas volume flowing through a pipe was and is dependant upon a calibrated bellows actuated by differential presure. The bellows is, in turn, connected to some sort of a recording device. As new materials have become available they have been investigated and some of them used. This same is true of changes in methods of fabricating either old or new materials of construction.

In order to measure accurately the flow of gas the various sections of the meter must be sealed. Since rather thin gauge sheet metal is used for many parts of the low pressure meters, soft soldering is the preferred method of joining. This soldering imposes a strict limitation on the materials of construction.

Another restricting factor as far as materials is concerned is the corrosive action of some of the gas components. Zinc in any form other than as a minor alloying agent cannot be used. Nearly all brasses and bronzes are severely attacked and when used must be heavily tin plated. Aluminum is only moderately attacked by the gases, but cannot be soldered easily. Black iron has the necessary corrosion resistance if the gas is dry, but when it is moist, as it may be, there can be corrosive attack. Cast iron is an excellent material from a corrosion point of view, but joining is a major problem.

Because of the limitations thus imposed, the majority of the low pressure gas meters are made of heavily tin plated sheet steel wherever sheet is used. Heavier sections that might normally be castings, forgings, etc., are usually a complex alloy of

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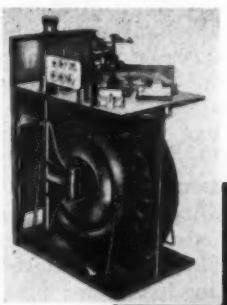

CORROSIVE ACTION of gas components is a deciding factor in choice of materials for the gas meter, left, manufactured by Superior Meter Co., Inc. Permanent mold castings in low melting alloys meet this problem very well. Range of castings produced from hand-held, book-type molds, is indicated by the two valve gratings, below.

GROWING interest has been shown in magnesium as a metal than can be cast commercially with a high degree of accuracy. Presented here are abstracts of three papers delivered recently before The Magnesium Association in New York pertaining to precision techniques for casting magnesium.

Four precision methods to cast MAGNESIUM

- DIE CASTING
- PERMANENT MOLD CASTING
- INVESTMENT CASTING
- SHELL MOLDING

A MAGNESIUM INVESTMENT CASTINGS, Paul L. Butler, Chief Metallurgist, Arwood Precision Casting Corp.

INVESTMENT casting or as it is sometimes called "Precision Investment Casting" is a relatively new industrial method of forming finished or semi-finished metal parts. The basic fundamentals of the process have been used for many years in the arts and dental trades.

In the beginning, considerable trouble was experienced, as is usually the case with anything new, in that the metal after casting would explode and blow out of the flask or would burn with a "flower pot" type of display which was interesting to watch but didn't produce any castings. It was found that the molten metal tended to react with the investment material (silica and plaster) producing the previously mentioned fire works or, if the reaction did not go far enough, a relatively good

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B THE SHELL MOLDING PROCESS AND MAGNESIUM CASTINGS, A. J. Marotta, Utica Radiator Corp.

COINCIDENT with the increased interest in the shell molding process has come an increased use of magnesium castings. The obvious step, therefore, is to try to combine the two into magnesium castings made by the shell molding process.

Utilizing the conventional methods of shell molding trouble was encountered due to burning of the magnesium after casting. In some cases, a usable casting would result if the burning could be limited to the region of the riser, in other cases complete or almost complete destruction of the casting would take place.

Experimental work finally developed an inhibitor that is added to the sand-plastic mixture which effectively reduces or eliminates the burning. Thus far a mixture of sulfur and potassium fluob-

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C AUTOMOTIVE SERVICE EXPERIENCE WITH MAGNESIUM, F. H. Mason, Chrysler Corp.

SINCE the primary purpose behind the application of magnesium to the car has been to reduce cost, all consideration has been devoted to die castings and permanent mold castings. This has proved to be the most advantageous form, not only from a standpoint of part cost but also because of savings in machining resultant from coring and close dimensional control in the casting operation. Thus we find that parts of the following type are in production or have been used in production:

1. Clutch housings; 2. Torque converter housings; 3. Transmission parts; 4. Oil seal plates; 5. Steering column shrouds; 6. Steering column brackets; 7. Fan spacers; 8. Convertible folding top pillars, rails, and hinges; 9. Instrument panel housing and bezels; 10. Generator end plates.

continued on page 72

Raw material storage room where ingots are held for laboratory analysis. Temperature is controlled to prevent moisture pick-up.

Electrically operated melting furnace in the Thompson foundry being tapped. Molten metal is held in gas fired holding furnaces at the casting operations.

A modern high-pressure, cold chamber die casting machine in operation at Thompson Products' Light Metals Division foundry.

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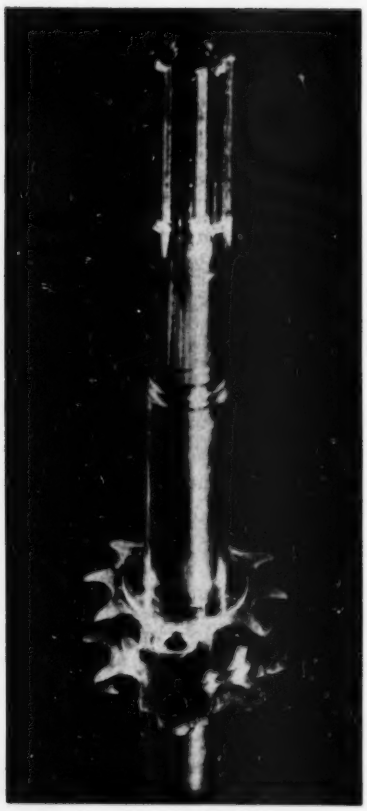
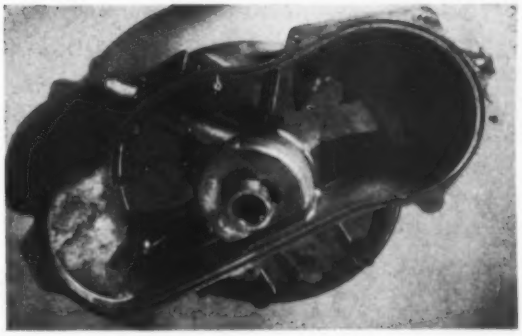
New type power transmission system uses DIE CAST elements



DIE castings have long been utilized for power transmission elements. Among such applications are pulleys and gears for textile machines, light machine tools, household appliances and special purpose machinery. Certain types of gears and pulleys have become so widely accepted that they are produced from stock dies in standard sizes.

One of the newest and most significant places in which die castings are being used to transfer motion is in the transmission for automatic washing machines manufactured by Bendix Home Appliances, South Bend, Indiana.

A unique drive mechanism developed for Bendix by Micro Products Corp. of St. Louis works on a principle similar to that of the ancient spindle and bow used in making fire by friction. Here, the shaft which supports the washing compartment is rotated alternately clockwise and counterclockwise by means of a "bow" attached to it by sprocket and chains. One end of the "bow" is mounted in an eccentric driven by the motor. As the eccentric rotates, the "bow" makes a complete forward and reverse motion, turning the shaft in alternate directions.



2. MULTIPLE CORING has made the lower transmission housing, right above, less expensive as a die casting because openings can be formed in many angular relationships. Simpler upper transmission housing can be cast in gray iron because few secondary operations are involved, lower right.

Two key elements in this power transmission unit are the "bow" and the sprocket. Since there is a double chain drive, a double sprocket is required. Both the sprocket and the "bow" are produced by die casting.

The sprocket is an instance where a die casting is produced with an insert several times the size of the casting itself. The sprocket is cast directly onto the shaft and thus is a permanent and integral attachment.

The "bow" is also cast with an insert. Here, the steel pivot is an insert, thus insuring accurate location and rigid assembly. Both the "bow" and the sprocket are heavily stressed and a durable union between shaft and casting is required.

Figure 1 shows the detail of these two unusual castings. It will be noted that the stress is carried by the two die castings, being transmitted from the pivot, through the "bow", to the basket shaft by means of the chain and sprocket. To meet this loading, the "bow" has been substantially "beefed up". In Figure 1 can be seen the longitudinal rib and the increased section around holes. The "bow" die casting is an excellent example of the ability to place metal where it is needed for reinforcement. This casting is essentially an "I" section with rigidizing ribs and heavier sections where specifically needed.

Die castings are not newcomers to Bendix products. Many types of small-to-medium sized housings such as the lower transmission housing shown in Figure 2. This complex piece, with its long holes formed by side cores in the die, its numerous mounting bosses, integral recess for peripheral seal, and reinforcing ribs, represents a marked saving over heavily machined and castings formerly used. Where shapes are simpler and secondary operations relatively few, some grey iron is still being used.

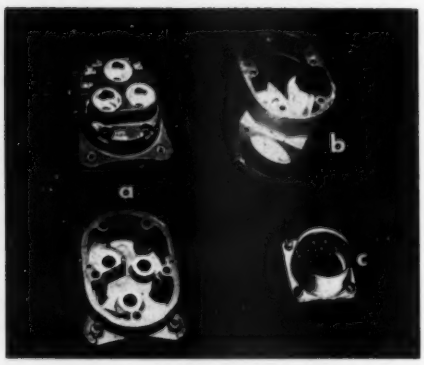
Both aluminum and zinc alloys have found applications depending upon physical requirements, weight limitations and castability. The double sprocket is die cast in zinc alloy, whereas the "bow" is die cast in an aluminum alloy.

Reports from the field indicate that the many thousands of Bendix automatic washing machines in which this new transmission is incorporated are earning an excellent record of service.

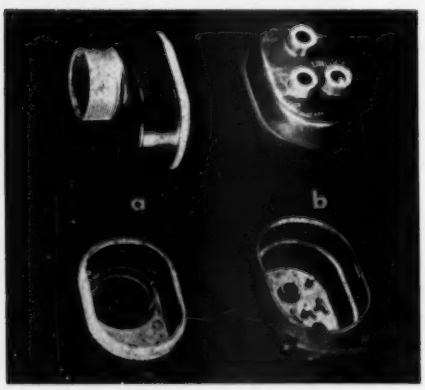
1. LOAD - CARRYING elements are shown at left; both die castings have inserts. The shaft which supports the washing machine basket has a double sprocket cast onto it, and the "bow" which is driven by an eccentric has a steel pivot cast into it. Note "I" section of the bow and the heavy reinforcements designed into it.

DO YOUR die castings take advantage of all that this process has to offer? Here is a company that found out . . .

. . . How to get the most from the DIE CASTING process



"As originally designed, this housing was an assembly of three aluminum die castings, above, requiring six gaskets and the drilling of several holes. The housing has been reduced to two thin-walled die castings, below, with all lugs, bosses, etc. formed integrally. Chromate treatment and paint spray give protective finish."



By MARTIN B. BRANDT*

BECAUSE it must be operable, through its entire useful life, under a head of six feet of water, as well as resistant to fungus and to extensive salt spray exposure, the housing for a master lighting switch for automotive use presented a considerable problem in design.

As originally conceived and manufactured, left above, this housing was an assembly of three aluminum die castings, the body, the cover, and the connector receptacle. This design required six gaskets just to make the joints holding it together water tight without counting the three switch lever oil seals. A further disadvantage was that several holes had to be drilled in the walls to allow mounting of some switch components and each of these holes had to be made water tight, after assembly, by the application of some sealing compound such as glyptol.

The lateral holes required the wall of the housing members to be quite thick to give the necessary support and rigidity for either machine screws or rivets. Assembly involved appreciable amounts of both machine work and hand operations, resulting in high costs. costs.

Finally, due to the plurality of joints, rejects due to leakage under hydrostatic testing were high. All of these objectionable features led the Joseph Pollak Co. to study the housing and the switch components with an eye toward simplification, size reduction and lower costs.

An analysis of the many problems involved indicated that any new design would have to be based upon the use of an aluminum die

continued on page 80

*Joseph Pollack Co., Boston, Mass.

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Little information has been published concerning the physical properties of investment cast alloys, especially in specific heat treated conditions. The results of tests by one investment casting foundry over several years are offered here, covering alloy and stainless steels and high temperature alloys.

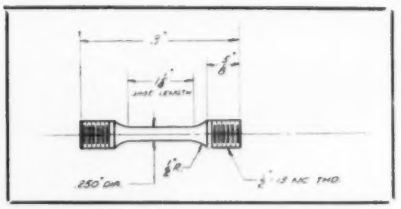
Some physical properties of INVESTMENT CAST alloys

By K. J. YONKER*

TO enable design engineers to evaluate the mechanical properties of investment cast alloys, the Howard Foundry Company has tabulated test bar data gathered over the past several years from production heats. Presented here are the tabulations of a limited group of ferrous and high temperature alloys, as cast and as heat treated which, it is felt, will give information of sufficient range to cover the majority of applications requiring these general types of alloys.

It is not implied here that these values represent more than the production experience of one company, but it is felt that the properties may be considered typical of the alloys and heat treatments indicated. Because test bars have been taken over an extended period of time, the average values are likely to be representative of regular production.

*Plant Manager, Investment Casting Div., Howard Foundry Co.



1. Standard ¼" test bars were poured statically in molds preheated to about 1800F.

All test bars pulled were standard ¼ inch diameter bars as shown in Figure 1. The test bars were made by the investment casting method using techniques identical to that used on production castings. The alloys were melted in induction furnaces either in a 30 KW unit or a 100 KW unit, and the molds were all poured statically.

Since investment casting inherently offers much greater freedom in gating parts and also

ALLOY STEELS

SPECIFICATION	SAE 8620	SAE 8630			SAE 8640	
COMPARABLE SPECIFICATION		AMS 5334;QQ-S-681b, CL4			QQ-S-681b, CL4	
CHEMICAL COMPOSITION	MIN. MAX.	MIN. MAX.			MIN. MAX.	
C	.18 .23	.25 .35			.38 .45	
Mn	.60 .95	.60 .95			.75 1.00	
Si	.20 .80	.20 .60			.20 .60	
P	.04	.040			.040	
S	.04	.040			.040	
Cr	.40 .75	.35 .90			.40 .75	
Ni	.40 .70	.35 1.10			.40 .70	
Mo	.08 .25	.08 .38			.08 .25	
CONDITION	C	C	OQ,D(750°-800°)	OQ,D(1000°-1250°)	C	OQ,D(1000°-1200°)
MECHANICAL PROPERTIES						
Tensile Strength (PSI)	88/100000	100/103500	167/187000	104/140000	127/131000	127/165000
Yield Strength (PSI)	63/78000	70/72000	160/181000	86/134000	92/101000	112/156000
Elongation 1 inch (%)	6/7	7/10	4/5	8/19	5/7	4/15
Reduction of Area (%)	6/7	7/18	2/10	10/50	4/6	4/31
Hardness	RB 88/92	RB 90/95	RC 33/35	RB 94/C25	RB 98/C24	RC 23/32

since the test bar molds are at a temperature of approximately 1800F. when the metal is introduced, it is felt that much sounder bars are obtainable than by other casting methods. Likewise, the same thing may be said of the investment cast parts themselves. For these reasons the physicals indicated on the attached table are generally better than those made in sand casting.

In comparing these mechanical properties with those of a rolled or forged structure, it can be seen that the tensile and yield strengths are about the same, but the elongation is slightly less. Furthermore the mechanical properties of an investment casting are the same in all directions. Whereas, in a forged structure the best properties are obtained parallel to the direction of working or rolling.

The tables below show that for the heat treatable alloys, test bars were pulled with several types of heat treatments in order to show the full range of mechanical properties that could be obtained.

STAINLESS STEELS

SPECIFICATION	AISI 304		AISI 310	AISI 347	AISI 410			
COMPARABLE SPECIFICATION	MIL-S-867A, ASTM A296-49T (CF-20)		AMS 5366	AMS 5363 ASTM A296-49T (CF8C)	ASTM A296-49T(CA-15), AMS 5350B			
CHEMICAL COMPOSITION	MIN.	MAX.	MIN. MAX.	MIN. MAX.	MIN.	MAX.		
C		.08	.18	.10		.15		
Mn		2.00	2.00	2.00		1.00		
Si		1.00	.50 1.00	1.50		1.00		
P		.04	.04	.04		.04		
S		.03	.03	.04		.03		
Cr	18.00	20.00	24.00 26.00	17.00 20.00	11.50	13.50		
Ni	8.00	11.00	19.00 22.00	9.00 12.00		.50		
Mo			.50	.50		.50		
Cu			.50	.50		.50		
Cb			.50	10XC 1.35				
CONDITION	C	ST	C	C	C	N,D(1200°)	OQ,D(1100°)	N,D(600°)
MECHANICAL PROPERTIES								
Tensile Strength (PSI)	81/77000	76/91000	67000	87000	156/175000	100/120000	121/134000	178/200000
Yield Strength (PSI)	36/44000	34500/48000	49000	41000	120/155000	89/108000	111/117000	152/184000
Elongation 1 inch (%)	43/60	54/68	34	22	9/10	13/20	18/16	9/12
Reduction of Area (%)	57/78	54/69	67	34	17/22	52/67	58/63	23/49
Hardness	RB 75/85	RB 75/85	RB 81	RB 76/78	RC 34/37	RB 94/99	RC 22/24	RC 38/40

STAINLESS STEELS

HIGH TEMPERATURE ALLOYS

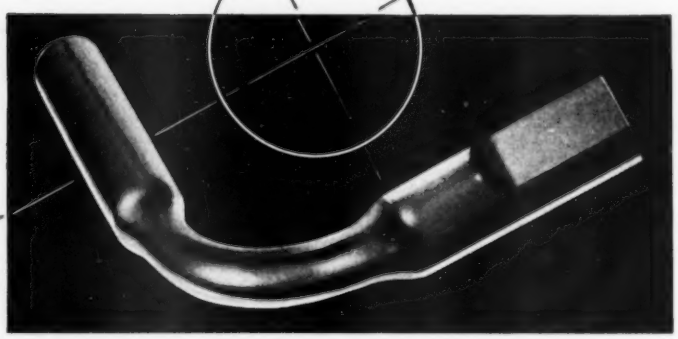
SPECIFICATION	AISI 416	ARMCO 17-4-PH				HAYNES-STELLITE #21		HAYNES-STELLITE #27	
COMPARABLE SPECIFICATION						(VITALLIUM) AMS 5385B		AMS 5378	
CHEMICAL COMPOSITION	MIN. MAX.	MIN.	MAX.				MIN. MAX.	MIN.	MAX.
C	.15		.08			Mn	1.00		1.00
Mn	1.25	.50	1.00			Si	1.00		1.00
Si	1.00		1.00			B	.007		
P	.070		.040			Fe	3.00		2.00
S	.070		.030			Cr	25.00 29.00	23.00	26.00
Cr	12.00 14.00	15.50	17.50			Ni	1.75 3.75	10.00	35.00
Ni	.50	3.75	4.75			Mo	5.00 6.00	4.50	6.50
Mo	.60					C	.20 .30	.35	.45
Cu		3.50	4.50			Co	Balance	Balance	
Cb									
CONDITION	OQ,D(500°)	C	ST	ST,A(900°)	ST,A(950°)	TESTED AT 1500°		TESTED AT 1500°	
MECHANICAL PROPERTIES									
Tensile Strength (PSI)	167000	155/161000	144/157000	180/196000	142/154000	52/62000		50800	
Yield Strength (PSI)	158000	86/145000	117/133000	147/178000	129/151000				
Elongation 1 inch (%)	6	3/15	4/11	4/13	4/14	10/19		15	
Reduction of Area (%)	13	8/21	13/45	10/29	23/47				
Hardness	RC 29	RC 29/31	RC 27/35	RC 37/43	RC 24/32				

C-As Cast, WQ- Water Quench, OQ-Oil Quench
St-Solution Treat, N-Normalize, D-Draw

14.75% ELONGATION

ALMAG 35

ALUMINUM ALLOY



TENSILE STRENGTH
40,940 LBS./SQ. IN.

Standard sand-cast test bars of ALMAG 35, bent beyond 90 degrees as shown, show no sign of fracture under closest microscopic examination.

This critical test graphically demonstrates ALMAG 35's superior ability to withstand severest punishment. Tough but pliable, ALMAG 35 possesses minimum 9% and typical 13-15% elongation . . . five to seven times that obtained in conventional alloys.

ALMAG 35 offers you the highest, most stable combination of tensile strength, impact resistance and ductility of any *as-cast* aluminum alloy.

Before you specify *any* alloy, request new Bulletin 350.

COVERED by U.S. PATENTS Nos. 2564044 and 2583473.

WILLIAM F. JOBBINS INCORPORATED

AURORA, ILLINOIS

P.O. BOX 230

For additional information Circle No. 19 on the Reader Service Card

INVESTMENT CASTERS met in an all-day session to discuss common problems, especially those relating to standards and feasibility of an industry-wide organization. Representatives of industry and government are shown here in two photos taken at a luncheon given by PMM.

First meeting of INVESTMENT CASTING industry discusses standards and organization

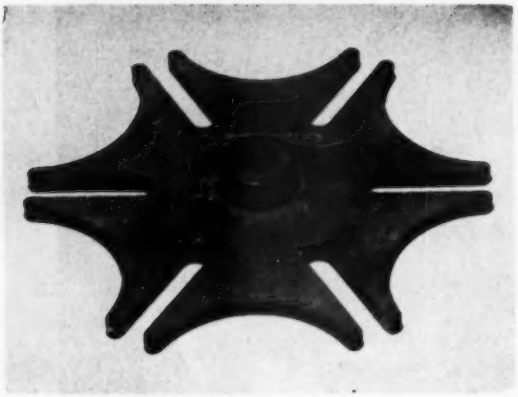
IN order to bring to their customers in both industry and government a uniform product through industry-wide specifications and standards, members of the investment casting industry met in Cleveland, Ohio on January 7 to consider steps leading toward the formation of a permanent organization.

The meeting was attended by representatives of a majority of the commercial producers of investment castings. While it was not possible, at this first meeting, to determine just what sort of an organization should be set up representatives present agreed that:

- Standards of quality, both physical properties and chemical composition, should be set up for the entire industry.
- Standards of tolerance and surface finish are needed.
- A common nomenclature must be devised so that the foundry and the customer are speaking the same language.
- Widespread dissemination of accurate information on investment casting must be encouraged.

As the first step K. M. Bartlett, manager of the Metallurgical Products Div., Thompson Products Co. was elected temporary chairman. Mr. Bartlett was directed to appoint a committee, working under him as chairman, to

continued on page 83



A GENEVA GEAR for a tap changer on a power transformer as cast in silicon bronze, left. Requirements are ± 0.005 on all dimensions except the bore. One machining operation, reaming the bore is all that is required to finish the part.

AIR COMPRESSOR part in manganese bronze, right. Cast to finished specifications, this part is ready for use when received from the foundry. Minimum tensile strength of the as cast part is 65,000 psi.

Substitution of PLASTER MOLDS for sand gives accurate, low-cost castings

IN dealing with any casting method as a means of producing metal parts the variables that are characteristic of molten metal are difficult and often impossible to control. When to these innate variables are added the relative crudities of sand as a mold material it is not at all suprising that all sorts of innovations are practiced to improve both the accuracy of the individual castings and the reproducibility from piece to piece.

The use of gypsum casting plaster as a substitute for all or part of the sand mold has developed into one of the best methods for securing superior dimensional stability and surface finish. One process using gypsum plaster as a mold material closely approaches sand casting in its practice.*

So closely does this process follow normal sand casting that the only essential difference is in the use of casting plaster in place of sand

---

***Data and illustrations have been provided by Ohio Precision Casting Co. of Dayton, Ohio who employ this casting method. This is one of several PMM articles on various techniques of plaster mold casting.**

as the mold material. Very few differences are required in gates or risers and pouring practice is the same, as are other details of the process. Probably the greatest single difference is in the fact that the molds are generally heated to about 200 or 300 F prior to pouring to eliminate moisture.

The low decomposition temperature of gypsum limits its use to molds for non-ferrous alloys, but in this field the fine grain size and the true reproduction of detail allow castings to be made that have an exceptionally high degree of precision in the as-cast condition.

Since the plaster is poured around the pattern as a fluid slurry it picks up every detail of the pattern. This faithful reproduction requires, therefore, that the pattern be dimensionally more accurate and have a better finish than is required for sand casting operations. Brass is the prefered material for patterns since it is easily machined and takes a superior finish. Pattern parts are mounted on a metal plate so that the resulting pattern is essentially a metal match plate similar to those common to sand foundries.

The majority of the applications of plaster mold casting are those where the degree of accuracy desired can be secured and a good surface finish developed, but where the number of duplicate parts is relatively small so that the cost of die casting dies or even permanent mold dies is not justified. Another major application of the plaster mold casting process is in making prototype die castings. Since the patterns are inexpensive and the process lends its self to very intricate coring, all of the design problems can be worked out before expensive dies are built.

Typical of the parts being made by this process are two pieces illustrated. While these parts are both bronze, brass and aluminum are also cast. The complete list of castable alloys with their approximate physical properties is given in Table 1.

TABLE 1

Alloy Designation	Composition	Approximate Physicals
95-5 free flowing aluminum	5% Si, bal. Al.	Ultimate 17,000 psi; 3% elongation
356 high strength aluminum	7% Si, 0.3% Mg, bal. Al.	Ultimate 30,000 psi; 3% elongation (heat treated)
355 high strength aluminum	5% Si, 0.5% Mg, 1-3% Cu, bal. Al.	Ultimate 32,000 psi; 2% elongation (heat treated)
195 high strength aluminum	0.8% Si, 4.5% Cu, bal. Al.	Ultimate 32,000 psi; 3% elongation, (heat treated)
Almag 35 aluminum	6 - 7% Mg, bal. Al.	Ultimate 35,000 to 40,000 psi; 9 to 13% elongation; 60 to 70 Brinell hardness.
Beryllium copper	2% Be, 5% Co and Fe, bal. Al.	As cast—Ultimate 60,000 psi; 15 - 20% elongation Heat treated—Ultimate 110,000 to 115,000 psi; 3% elongation; 35-42 Rc hardness
Ohio Precision mang. bronze.	58% Cu, 1% Zn, 1% Al, 1% Fe, 1% Mn.	Ultimate 65,000 psi; 20% elongation
40 Yellow brass	58% Cu, 38% Zn, 1% Al, 1% Sn, 0.5% Ni	Ultimate 70,000 psi, 15 to 20% elongation
Copper silicon bronze	2% Sn, 5% Zn, 2½% Fe, 1½% Mn, 5% Si, bal. Cu.	Ultimate 45,000 psi, 15% elongation
4 Tin bronze	88% Cu, 10% Sn, 2% Zn	Ultimate 30,000 psi, 14% elongation
9 Nickel silver		Ultimate 70,000 psi, 12% elongation

VELVAGLAZE

MONARCH VELVAGLAZED DIE CASTINGS USED ON THE GENERAL ELECTRIC CANNISTER CLEANER

Cuts Finishing Costs...

AND IMPROVES PRODUCT QUALITY

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Velvaglaze is available exclusively on Monarch aluminum Permanent Mold castings and aluminum Die Castings. Investigate the substantial savings you can obtain over other comparable fine finishing methods using Monarch Velvaglaze castings.

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- Every Modern Finishing Service

Detroit Ave. at W. 93rd St., Cleveland 2, Ohio

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SELF-LUBRICATING BEARING STANDARDS ISSUED BY MPA

Bearings made from sintered metal powders and impregnated with oil to make them self-lubricating have gained wide acceptance as a preferred bearing material. Universal acceptance, however, has brought with it the need for standardization. This need has now been met by two standards developed by the Metal Powder Association, one of which has just been released.

One of the first Standards to be set up for the benefit of the producers as well as the users of self-lubricating bearings was issued in June, 1951, by the M. P. A. Designated 14-51T and entitled "Metal Powder Sintered Bearings (Oil Impregnated) Preferred Dimensional Specifications," this Standard established a list of preferred bearing sizes commonly available from all manufacturers and, at the same time, correlated the bearing dimensions with those of stock shafting sizes and standard dimensions of other items of importance to bearing users.

This Standard has contributed much toward eliminating the design engineer's problems when faced with too many bearing sizes from which to choose. It is also helping to reduce overhead and similar expenses as well as to conserve strategic metals by cutting down on the huge inventories and stocks of odd-sized bearings that had to be maintained by bearing manufacturers and the larger consumers.

Dealing principally with dimensional specifications and tolerances this Standard does not specify other important factors such as composition, basis of purchase, density, porosity, crushing strength requirements and others necessary in the purchase of such bearings. The latter requirements have now been met in a new M. P. A. Standard just released. Thus specifications are

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POWDER METALLURGY-1953:

M.P.A. Meeting and Show Scheduled for April

PROGRAM for the Ninth Annual Meeting of the Metal Powder Association is almost completed and exhibit space at the 1953 Metal Powder Show held in conjunction with the meeting at Hotel Cleveland, Cleveland, Ohio, April 20-22, has been virtually sold out.

Judging from preliminary interest and activity, attendance at the meeting and show will exceed last year's record attendance of 600 metallurgists, engineers and executives from United States and Europe. Both the meetings and the show are open to anyone interested in the broad field of powder metallurgy.

Carrying through the meeting's theme "Progress in Powder Metallurgy," subjects tentatively scheduled for presentation include:

- The application of metallic friction materials in heavy duty transmissions such as tanks, airplanes and other military, as well as civilian uses.
- Flame plating, both as a new use for metal powders as well as a technique for improving the production of sinterings.
- A detailed report on progress in this country in the development and application of SAP (sintered aluminum powder)
- A leading business machines manufacturer will describe for the first time how they are producing and using iron powder and other metal powder sinterings in their products.
- The latest information about the powder metallurgy of refractory metal powders for special high temperature applications.
- A report on some new developments in brass powders.
- A survey review of where powder metallurgy stands today — whether it has progressed within the past year and, if so, how much and in what direction.
- The outlook for the electronic core industry, the effect of developments in radio and television manufacture, and the influence of ferrites, will be discussed by a leading electronic core consumer.

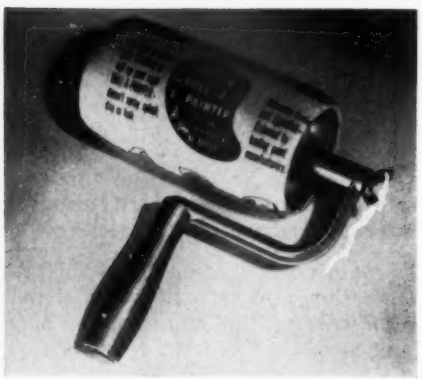
Promising to be one of its biggest meetings yet to be held all those planning to attend are urged to make their reservations as soon as possible after receiving hotel reservation cards.

Paralleling the attraction of the formal program at its Ninth Annual Meeting, the MPA will also continue its practice of sponsoring a "Metal Powder Show" consisting of exhibits by sinterings fabricators, powder producers and equipment manufacturers.

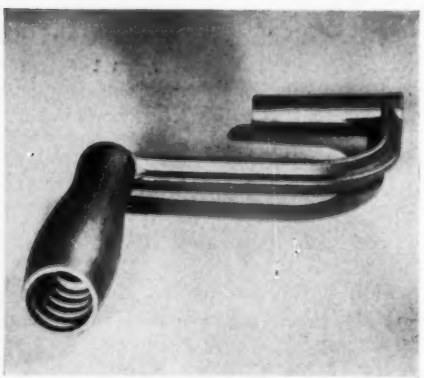
Exhibits for this year's show set record within the first three weeks after the show was announced more than 80 percent of the available spaces were contracted for.

ALL-OVER ABRASIVE BLAST gives attractive satin finish and simultaneous flash removal for die cast aluminum handle. Die casting process permits many design refinements.

Outboard bearing design of paint roller calls for DIE CAST construction



" . . . One-piece construction permitted by means of the die casting process saves money compared with screw machine bearing assembled to a formed wire, and also gives greatly improved appearance."



" . . . Die is built with a rotating core that forms a coarse internal screw thread. Thread fits onto mop handle to make painting ceilings easier."

RAPID public acceptance of the roller type applicator for painting walls has brought a number of companies into the field to manufacture paint rollers. This has resulted in a highly competitive situation in which the consumer has benefitted by getting better rollers at lower cost.

For example, in a period of three years, the S-X Graham Company of Chicago has become a major manufacturer of these paint rollers. Their rollers are sold in hardware, department and chain stores from coast to coast. This tremendous growth in a short period has been accomplished by refinement of the details of their paint rollers for improved performance, and by strict cost engineering to pare out every cent of unnecessary expense.

There are two general types of paint rollers: dip type which is dipped into the paint held in a sloping pan and then applied to the surface to be painted; and fill type which holds a pint of paint inside the roller. The latter type feeds the paint through the roller as it is applied to the surface, eliminating the need for dipping.

Two different types of construction have been found practical for these distinctive roller types: for the dip type which can have its bearing inside, S-X Graham has found that a heavy, formed wire mounted in a wooden handle grip is the least expensive construction. On the other hand, for the fill type, where an outboard bearing design is needed, a die cast handle is less expensive.

At the same time, the die cast handle permits incorporation of a number of extra features. Observing that one of the most troublesome areas for an amatuer to paint is the ceiling, S-X Graham designers have provided a hollow handle with coarse internal screw thread to fit the thread on an ordinary mop handle. Thus, without purchase of extra accessories, or the use of ladders, the

continued on page 71

KUX

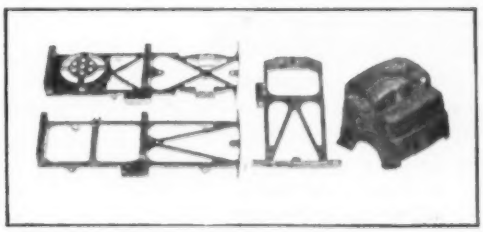
FIRST NAME IN DIE CASTING MACHINES

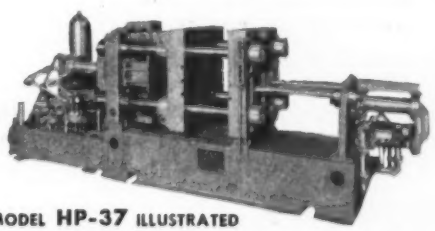
used by STRUCTO first name in realistic toys

UNGENTLE YOUNG HANDS put famous Structo trucks, trailers and steam-shovels through their "live-action" paces again and again. Toys have to be tough to take that. Structo *is* tough. Employing KUX die casting machines, Structo gets lightweight, structural castings of extra-ruggedness . . . to build toys that last a child-time of pleasure!

Is YOUR PRODUCT conditioned for the treatment it has to take? Quality die castings often make a tremendous difference in costs and saleability. KUX, first name in die casting machines, can make that difference for You!

Write for illustrated catalog showing complete line of KUX Die Casting Machines.





MODEL **HP-37** ILLUSTRATED

Hydraulically operated die casting machine for production of aluminum castings.

KUX MACHINE COMPANY • 6725 N. RIDGE • CHICAGO 26, ILLINOIS

KUX

FIRST NAME IN DIE CASTING MACHINES
SELECTED BY FIRST NAMES IN INDUSTRY

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...and now

Metal Hydrides INCORPORATED

Chrome-Nickel Alloy Powder 800 A

12-24 CONGRESS STREET BEVERLY, MASS.

CUSTOM ALLOY POWDERS for ALLOY STEEL COMPOSITIONS* ...high tensile strength

*Chromium Nickel Powder or Nickel Chromium Powder —combined with electrolytic iron powder

Multiple advantages accrue to you through the use of MH Chrome Nickel alloy powders for Alloy Steel compositions in your powder metallurgy molding —

- volume production of intricate parts having higher tensile strength
- miniaturization of parts with greater strength and less mass
- no scrap or waste no milling or finishing required

Fine particle size is an outstanding feature of MH Chrome Nickel alloy powders, as indicated on the chart below.

TABLE XIII

COMPARISON OF EFFECTS OF HEAT TREATMENT ON PROPERTIES OF ELECTROLYTIC IRON POWDER PLUS ALLOYS OF VARIED NICKEL—CHROMIUM CONTENTS

Compacting Pressure — 50 Tsi.
Sintering Condition — 1100 C for 1 hour at temperature in hydrogen

MATERIAL	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Ni — 20% Cr) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G CC	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Cr — 20% Ni) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G CC
Sintered	72200	2.5	Rb83	7.11	66100	2.0	Rb99	6.64
Coined	76300	4.6	Rb85	7.18	83000	2.0	Rb95	6.65
Coined & Annealed	71000	3.5	Rb84	7.15	84400	2.0	Rb95	6.65
Coined & Quenched	76900	1.7	Rc25	7.08	92900	2.0	Rb100	6.65
Coined, Quenched & Annealed	99500	0.5	Rc15	7.08	84000	2.0	Rb96	6.65
Quenched	75800	2.3	Rc19	7.11	77300	2.0	Rb97	6.65
Quenched & Annealed	88650	2.3	Rc16	7.11		2.0	Rb95	6.65

Size Characteristics—(80% Ni — 20% Cr)

+ 100	2.4%
100 + 200	31.9%
200 + 325	28.5%
325	37.2%

Size Characteristics—(80% Cr — 20% Ni)

+ 100	4.7
100 + 200	9.7
200 + 325	80.6
325	

For detailed information, write:

MH METAL HYDRIDES INC

20 CONGRESS STREET • BEVERLY • MASS.

For additional information Circle No. 36 on the Reader Service Card

JOIN FACILITIES TO MAKE SHELL MOLDING EQUIPMENT

SPO Inc. and Shellmold and Machine Co. Inc., of New York, N. Y., have announced the completion of an agreement under which SPO's manufacturing and distribution facilities will become available to Shellmold and Machine Co. for the production and distribution of their complete line of shellmolding machinery and auxiliary equipment.

Featured in the Shellmold line and covered in the agreement with SPO are the new hand and air-operated Types SU-H and SU-HP shellmolding units developed specifically to meet the average foundry's need for a production unit scaled to its operational requirements.

Included in the agreement, and therefore also available through SPO's facilities, is the automatic Type SU-1 shellmolding machine, a single-station unit already in use in foundries producing stainless steel valves and a wide variety of other cast-metal parts for the automotive, farm implement and aircraft industries.

Other equipment to be handled by SPO includes Shellmold's automatic-metering sand-resin-mix recharge feeder as well as equipment for blending, mold removal and mold closing.

A. F. GAGNE, JR. OPENS ENGINEERING FIRM

A. F. Gagne, Jr., has announced the opening of an office of consulting engineering under the firm name, A. F. Gagne, Jr. and Associates at 11 Chestnut St., Binghamton, N. Y. The firm will specialize in machine design and development, cost reduction in plants, trouble shooting, product development and design, and peak-load assistance.

PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

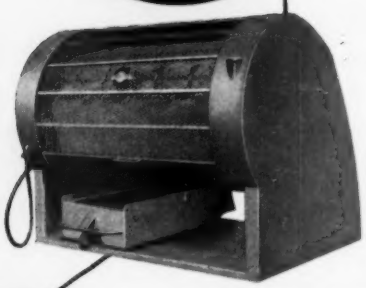
A Section Devoted to Specialized Finishing of

Die Castings • Investment Castings • Powder Metal Parts
Permanent Mold Castings • Plaster Mold Castings

Come to TUMBLE GRAV-I-FLO FINISH for ALL your tumbling needs!

You can get complete equipment and supplies for faster, better tumbling at Grav-i-Flo. This authoritative tumbling source can furnish you, from its years of experience, the correct answer to any tumbling problem.

Larger capacity machines take 31% to 80% more work-load in same floor space. Improved cutting materials shorten cutting cycle by 15% to 25%. Grav-i-Flo installations substantially reduce capital investment, floor space, and production time!

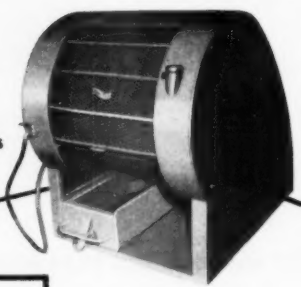


Model 66″, two compartments

MACHINES

Model 48″, two compartments

Grav-i-Flo 66″, 48″ and 36″ machines have cam locked doors with manually released safety stops; available with unlined or rubber lined cylinders, constant or variable speed drive, J.I.C. controls, and timers from 5 minute to 20 hour cycles. Equipped with electric wiring and water piping installed ready for plant hook up.



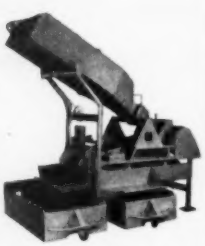
Model 36″, two compartments

Model 24″, two compartments

Designed For Small Lot Production and Laboratory Processing.

ACCESSORIES

Two deck parts-and-chips separator and chip grader



Occupies less floor space. Separates parts quickly without impingements. Grades 3 sizes of chips simultaneously.

Other Grav-i-Flo accessories include tubular yoke hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.

Chips and compounds

Grav-i-Flo natural and synthetic deburring and finishing chips and highly developed compounds consistently outperform every type of tumbling process offered on the market.

Investigate!

Grav-i-Flo superiority in equipment and supplies has been proved to hundreds of users in many different industries. Let us show you, too, at no obligation. Our representative will visit your plant, or send samples direct to us. Engineering Service available to all users.

SEND FOR CATALOG showing complete line of Grav-i-Flo equipment, accessories and supplies.

THE GRAV-I-FLO CORPORATION

Dept. PM-2 400 Norwood Avenue
STURGIS, MICHIGAN

For additional information Circle No. 31 on the Reader Service Card

AS CAST, die cast zinc surface is smooth and detailed, but . . .

. . . needs one or more polishing and buffing operations before plating.

Photos courtesy Lea Mfg. Co.

Polishing and buffing zinc DIE CASTINGS— a preliminary to electroplating

WHAT is regarded as one of the most useful features of zinc die castings — their ability to be somewhat elaborately formed, varied in section and sharply detailed — is the same feature which is likely to cause difficulty in finishing.

Variations in section and depth of detail which might disturb the smooth flow of metal into the die, likewise present contours and surfaces not easy to polish and buff or, for that matter, to reach with chromium plate.

In between the time a casting leaves its die cavity until it is eventually plunged into the first bath on its way toward chromium beauty, several preliminary mechanical operations are necessary to prepare the surface. These stages of grinding, polishing and buffing represent the most time — consuming and sometimes, the most expensive portion of the finishing cycle. They are, nevertheless, indispensable to the attainment of a brilliant lustre to meet the discriminating taste of the auto or appliance buyer.

A brief review of some of the steps in polishing and buffing die castings should be useful to the designer of die castings, as well as to the production man.

continued next page

CHECK LIST
of successful uses of

Luster-on® on Zinc

replacing Chromium, Cadmium or Nickel plate, offering Corrosion-Resistant, Brilliant Finish at Lowest Cost

- ✓ Cabinet hardware
- ✓ Small tools (wrenches, etc.)
- ✓ Auto body parts
- ✓ Bathroom hardware
- ✓ Aircraft metal parts
- ✓ Wire goods
- ✓ Refrigerator shelves
- ✓ Radio speakers, chassis, shields
- ✓ Television parts
- ✓ Electrical parts
- ✓ Air conditioning fans, guards, etc.
- ✓ Bolts, nuts, washers, rivets
- ✓ Builders' hardware
- ✓ Outdoor metal articles (fences, trailers, etc.)

also

- ✓ Protective finishes

covered by Federal Specifications for Army Signal Corps, Army Ordnance, Army and Navy Aeronautical.

THE Chemical CORPORATION
66 Waltham Ave., Springfield 9, Mass.

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A designer can often circumvent difficult finishing problems that increase costs if he is aware of the secondary operations that are to be applied to each casting.

The chilled surface of die castings

Die castings are produced by injecting molten metal into a steel die under pressure. This rapid chilling action creates a surface which is somewhat more dense than the center portions of the casting.

It may be stated that this dense surface should be left intact wherever possible in order to avoid break-through to the micro-or macroporosity of the inner portions. In practice, this is not possible, since there are always parting lines, ejector flash, gate marks and flow marks to be eradicated even though with modern die casting techniques, it is possible to produce "hardware finish" on castings having complex shape.

Likewise, with modern polishing room techniques, it is possible to cut, blend and contour surfaces with minimum destruction of the desirable "skin".

Trimming is the first treatment to which the casting is subjected, and it is by no means unimportant. If the parting lines have been thoughtfully located so that no flash falls on surfaces to be finished, and thickness of overflow vents and gating has been minimized, the trim die can cut close to the surface, and will leave little roughness to be cut away by polishing.

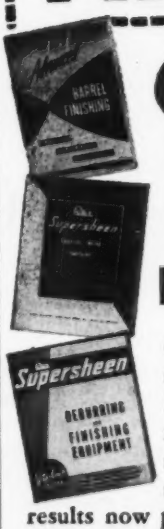
Naturally, a peripheral contour that is relatively simple makes possible a closer trim die and consequently, less flash root to be polished away. Location of flash on crowned surfaces also helps to get a clean job of trimming.

Where flash is heavy, first step after trimming is likely to be an abrasive belt cutdown to remove excess metal, eradicate large differences in contour and generally, to clean up around main parting lines. When the objective is metal removal, coarser grained belts are employed and the surface retains marks from the grain.

The next step, therefore, is the removal of all such grain marks, the blending of contours and refinement of surface. This step also involves metal removal and is called polishing. It commonly requires a flexible wheel made up of discs of cotton fabric, felt or leather. The discs are sewed or bound together in varying patterns and folds to give specific performance. Choice of material, sewing, and construction will yield a wide range of cutting and polishing performance.

The wheel of cloth or leather is placed on the polishing lathe and compound containing an abrasive and binder is applied to the edge of the rotating wheel. The work piece is then brought into contact with the wheel and the polishing operation performed.

FREE!



61 PAGES OF FACTS FIGURES PHOTOS ON BARREL FINISHING

Get the complete story! Learn about latest developments in equipment, compounds, abrasives. Amazing results now possible on almost all types of parts from large castings to small intricate parts.

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ALBERT LEA, MINNESOTA

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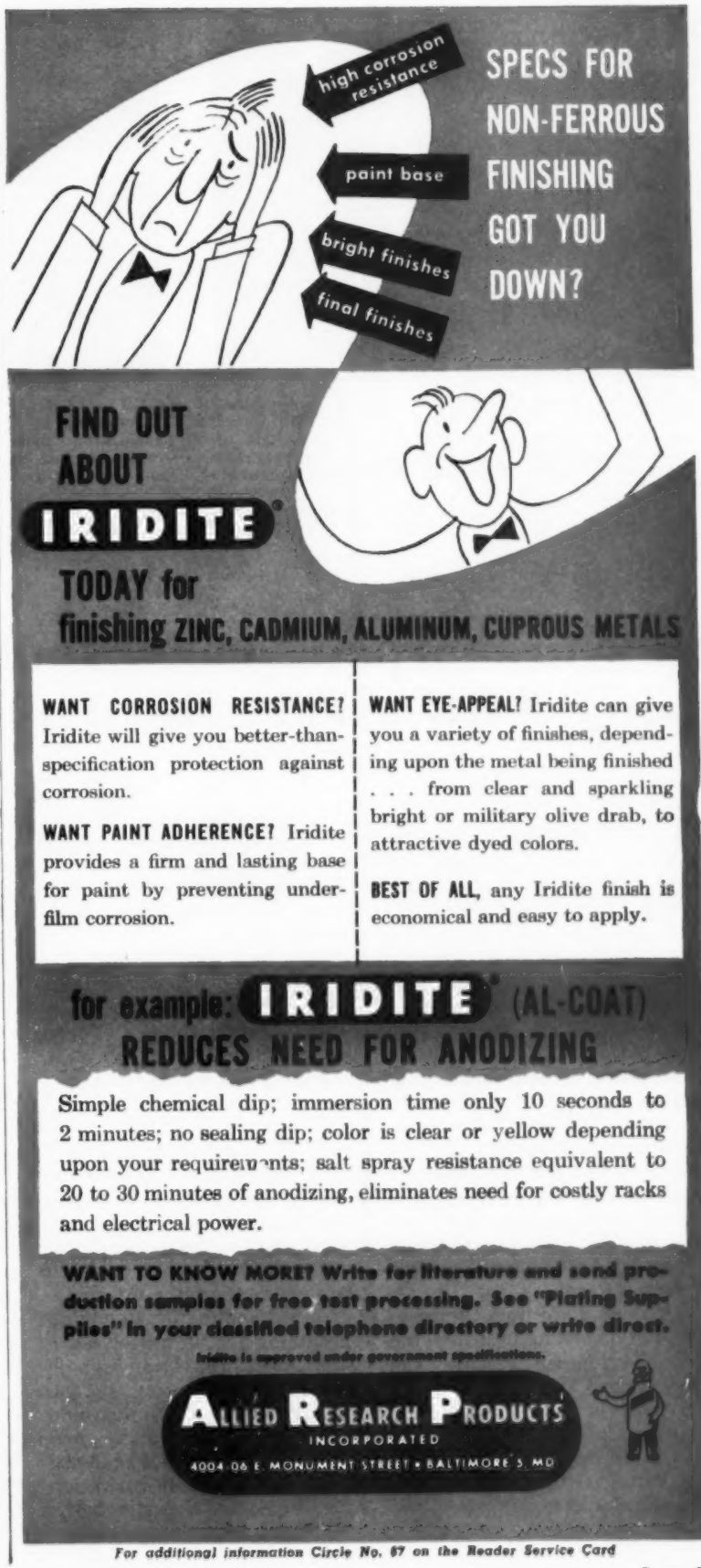
Manual or automatic polish

Depending upon the shape of the casting, either a manual or an automatic polishing (and subsequently, buffing) may be done. Where the shape is complex, hand manipulation may be necessary. This is slower than automatic, but is necessary in a large percentage of all work. Where shapes and quantities lend themselves to the operation, automatic polishing and buffing machines are available. These are multiple-station, straight-line or rotary machines with a series of polishing and/or buffing wheels located in different angular relationship to the work. As the work moves from one station to the next, new surfaces are exposed to the wheel action. This may completely polish and buff a casting, or leave final work for a manual operation.

The difference between polishing and buffing is largely one of degree. Both are done with flexible wheels which conform to the surface being finished. By varying the degree of flexibility, along with compound, wheel speed and wheel construction, different results can be obtained. Buffing removes little or no metal, involves finer grained abrasives, and produces a lustre as much by its burnishing and cold flow as by metal removal.

Compound may be applied to the rotating buff either by pressing a bar of the compound against the edge, or by spraying a liquid compound. The first method is most commonly employed in manual operations, whereas the latter has gained wide usage as part of automatic setups.

Buffing is subdivided into classifications, depending upon the final surface to be produced. In the majority of cases, a cut-down buffing operation with sewed or pocketed buffs is sufficient to provide a plateable surface. Buff speed up to 8,000 sfpm is used. For higher lustre, coloring is the second buffing treatment.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bright finishes
final finishes
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FIND OUT ABOUT IRIDITE® TODAY for finishing ZINC, CADMIUM, ALUMINUM, CUPROUS METALS
WANT CORROSION RESISTANCE? Iridite will give you better-than-specification protection against corrosion.
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Simple chemical dip; immersion time only 10 seconds to 2 minutes; no sealing dip; color is clear or yellow depending upon your requirements; salt spray resistance equivalent to 20 to 30 minutes of anodizing, eliminates need for costly racks and electrical power.
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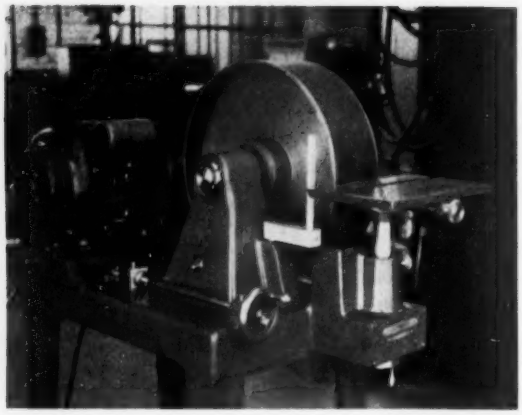
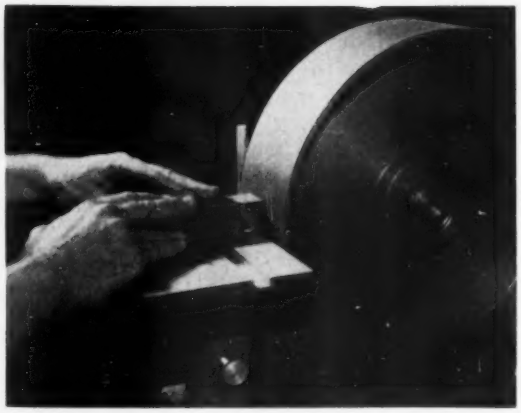


TURNED from special cast iron of exceptional hardness, the contact wheel on the carbide tool grinder supports a waterproof abrasive belt of silicon carbide on paper backing. Lever-operated cam in the motor mount maintains belt tightness.



CURVATURE of the contact wheel at a point corresponding to the desired angle marked on the calibrated posts produces relief angle. Light pressure and 2-3 second grind produces cutting edge on the tool.

How to sharpen carbide tools using ABRASIVE BELTS

A NEW method of sharpening tungsten-carbide cutting tools, without a diamond wheel, costs approximately 2/3 less per tool sharpened than the conventional diamond wheel method, and produces a longer lasting cutting edge on the tool.

A result of co-operative engineering between Behr-Manning Corporation of Troy, N. Y. and Fenlind Engineering Company of Rockford, Ill. the machine for the new method uses as a grinding element a coated abrasive belt that travels over a cast iron contact wheel specially formulated for extreme hardness.

Of immediate importance to the metalworking industry, the new development removes the urgent need for diamond grinding wheels now in critically short supply. And because of its lower operating costs and the better cutting edges it produces, it makes tungsten carbide tipped cutting tools available to an estimated 60,000 small shops which cannot afford the diamond wheels previously necessary for sharpening purposes.

Field tests by Behr-Manning engineers show that belt costs for sharpening tungsten-carbide tool bits range between one and three cents per tool. Sharpening carbide tools by the conventional method costs 6 to 17 cents per tool sharpened. In addition to this two-third reduction in cost of materials, the abrasive belt procedure eliminates two traditional steps without sacrificing cutting tool performance. With the new method, the intermediate grind and the finish-honing operations are no longer necessary. After the clearance angle has been rough-ground on the tool with a silicon carbide wheel, the relief angle and final cutting surface can be micro-finished in one operation with the coated abrasive belt.

Working life of tungsten-carbide tipped cutting tools sharpened by a coated abrasive belt is reported to average about double the life of those sharpened conventional methods. In one controlled test made on a production line turning 5665 nickel alloy, the carbide turning tools sharpened by diamond wheels averaged 12 pieces per resharpened tool. In contrast, those sharpened by a coated abrasive belt completed an average of 34 pieces before resharpening was required. In another shop where parts made of AMS 5060 steel were being machined, diamond wheel sharpened carbide tools produced 120 pieces but the belt-ground tools turned out an average of 202-1/3 pieces per resharpened tool.

The comparatively finer finish produced by the abrasive belt on the cutting face of the carbide tip accounts for the extended tool life. A finish of 2-16 micro-inches rms is put on the

tool by the 220-grit belt. In addition to the better finish it produces, the belt method does not produce chipping on the cutting edge of the tool that must be honed off with a diamond hone when carbide tipped tools are sharpened by conventional methods.

The machine that makes possible this method of sharpening carbide tipped tools is called the Fenlind Micro-Finisher. The waterproof silicon carbide paper belt is driven by a 14 inch cast iron contact wheel. The height of the work table can be adjusted in relation to the contact wheel to permit any normal relief angle to be micro-finished on the carbide cutting tool.

New method of setting relief angle described

The method of setting the relief angle on the cutting tool with this machine is new to the tool grinders' trade, and reflects simple but ingenious design. The relief angle is set by adjusting the height of the table until the face of the cutting tool contacts the belt on the periphery of the contact wheel at a point on its curvature that corresponds to the relief angle desired. A vertical gauge, marked in degrees from one to 22, is accurately mounted near the table at the left of the wheel. Proper table height is established for a desired relief angle by aligning the cutting edge of the carbide tip with the correct angle marking on the vertical gauge.

The procedure for sharpening carbide tipped tools with the belt method involves two steps; first, rough grind the clearance angle with a silicon carbide grinding wheel. Second, with the belt machine table set to produce the correct relief angle, micro-finish both front and side relief angles of the tungsten-carbide tool, and micro-finish the nose angle by swinging the tool through approximately a 90-degree arc. Light manual pressure is adequate to produce a fine finish and no edge of the cutting tool need be held against the belt for more than two or three seconds.

The new machine is being operated currently in Behr-Manning demonstration rooms in 16 major industrial cities across the country.

OPENS EASTERN BARREL FINISH COMPANY

Opening of a new barrel finishing company to serve the East Coast area, Metal Finish, Inc., 410 Freylinghuysen Avenue, Newark 5, N. J., has been announced by Paul E. Kirchartz, president of the firm.

A distributor for "Honite" barrel finishing equipment, "Honite" and "Super Honite" chips and "Honite" compounds, the new firm specializes in

The ABBOTT METHOD

will do MOST of your BARREL FINISHING

Constant research and production line operations, developed and improved by Abbott engineers for more than forty years, conclusively PROVES that the Abbott Method of Barrel Finishing will efficiently perform most of your barrel finishing tasks.

The Abbott Method — originated by The Abbott Ball Company in 1910 — features the famous Abbott Vertical Barrel and Abbott's scientifically designed Burnishing Shapes.

For superior barrel finishing of stampings, castings and machined parts . . . investigate The ABBOTT METHOD.

Improved Abbott Barrel!

The famed Abbott Vertical Barrel — adjudged by experts as the most efficient in its field — has been improved! Self-contained, it features its own electric motor and speed control which gives precision control of barrel speeds at all times. Four basic barrel sizes in a combination to match any production requirement. Write for details . . . today!

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ABBOTT ABCO & ECLIPSE BALLS
ABBOTT DIAGONALS
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ABBOTT PINS
ABBOTT BOBS
ABBOTT DISCS.

USE ABBOTT . . . THE SHAPE THAT COUNTS

ABBOTT

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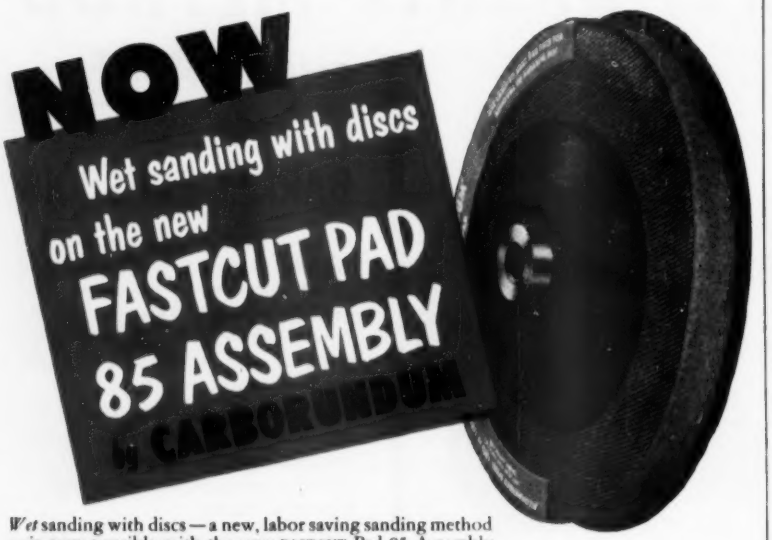
tumbling equipment, supplies, and service.

Among services provided are engineering and sample processing to determine proper application of the barrel finishing process in a customer's plant; sales engineering of complete barrel finishing installations; and job shop or custom barrel finishing work.

The new plant, with an area of 9,000 square feet, consists of a barrel finishing shop for job work, office and laboratory facilities and warehouse space. The shop will also be used for training customer personnel and for demonstrations of equipment and barrel finishing methods.

OAKITE REPRESENTATIVE GRANTED AWARD

L. T. Prince, technical service representative of Oakite Products, Inc., manufacturers of industrial cleaning and allied materials, has been granted the D. C. Ball Award for Distinguished Service from John A. Carter, Oakite president. The award, in the form of a bronze plaque, is presented annually to the member of the firm's nationwide field organization judged to have rendered the most outstanding service to industry during the year. Presentation of the award which is given in memory of David Clifton Ball, pioneer in industrial cleaning procedures, founder of the company, and former chairman of its board of directors, was made at a technical-sales conference of Oakite field representatives held recently at the Sheraton Hotel in St. Louis.



Wet sanding with discs—a new, labor saving sanding method—is now possible with the new FASTCUT Pad 85 Assembly by CARBORUNDUM. The 8" diameter FASTCUT Waterproof Paper disc by CARBORUNDUM used with this assembly has many more cutting points than quarter size sheets used in hand sanding, or cut sheets used on vibrating sanders. Thus you can sand a much larger surface in the same time.

With this new method, finger marks are eliminated, giving a better finishing surface. Output per man increases while operator fatigue is lessened considerably. And it's simple to make the changeover in equipment.

Find out all the advantages offered by the FASTCUT Pad 85 Assembly and FASTCUT Waterproof Paper discs—from your CARBORUNDUM distributor, or by sending the coupon.

- **Better finishes in far less time**
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DIVERSEY APPLIES NUCLEAR APPROACH TO PROBLEMS OF METAL FINISHING

The Diversey Corporation is pioneering into the field of applied nuclear research that is expected to help to develop new and improved pre-finishing cleaners as well as new type protective and decorative coatings for the metal industry, it has been announced. The purchase of radioactive isotopes from the government's atomic pile and the necessary equipment for measuring their presence and radiation will be employed to test effectiveness and behavior of metal cleaners.

In testing cleaning compounds, for example, tagged or radioactive carbons are incorporated into soil. The soil is then spread upon the surface to be cleaned. After cleaning, on what would appear to be a clean surface, small amounts of the radioactive soil could be detected on the electronic instrument. The soils are detected quantitatively. Where no count could be measured it would indicate the cleaner was very effective in removing the particular soil.

Apart from using the radioactive material to determine how effective certain cleaners

are in removing soils from metal surfaces prior to electroplating, the new research technique is expected to solve such problems as determining corrosion or absorption of inhibitive chemicals on metal and the effect of impurities in the plating solution.

Besides radioactive carbon, radioactive glucose and calcium are also available from the government, as well as many synthesized chemical compounds having radioactive carbon. These will be introduced into products and material pertaining to the above research problems by Diversey.

MOVE DISTRICT OFFICE

American Wheelabrator & Equipment Corp., Mishawaka, Ind. has announced that its district office in New York City has been moved to 53 Newark Street Bldg., Hoboken, N. J. Telephones are Hoboken 2-8550 and 2-8551.

ILLINOIS TECH OFFERS INDUSTRIAL FELLOWSHIPS

About 15 industrial research fellowships in physics, chemistry and chemical engineering, metallurgy, ceramics and minerals, engineering mechanics, and electrical engineering are being offered by Armour Research Foundation of Illinois Institute of Technology to begin in September 1953.

Research fellows will attend Illinois Institute of Technology half-time and work in the Research Foundation half-time in a graduate program leading to advanced academic degrees They are employed full-time by the Foundation during the summer.

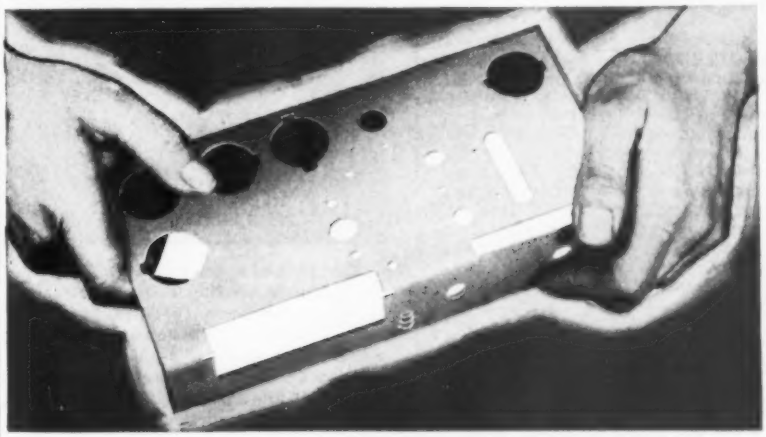
Awards are made on a competitive basis to U. S. citizens under 28 years of age holding a bachelor's degree from an accredited engineering or scientific school or a liberal arts college with a science major.

In addition to tuition, fellows are paid $165 a month during the first academic year, $325 a month with a two-week paid vacation during the summer, and $190 a month during the second academic year. Successful candidates are encouraged to accept full-time employment during the summer preceding the Fellowship at a rate of $300 a month.

Application forms may be obtained from the Office of Admissions, Graduate School of Illinois Institute of Technology. Applications received prior to March 15, 1953, will be given first consideration.

ABRASIVES MANAGER

Arthur N. Suddith has been named manager of the new abrasive division of *Whittaker, Clark & Daniels, Inc.* of New York.



COPPER-PLATED PARTS STAY BRIGHT AND CLEAN

When the plating shop treats them with WATER DIP #33

● If you are doing your own copper plating or buying copper-plated parts . . .

Then you'll want the full story on a simple, low-cost metal treatment that *keeps* the copper surface bright and chemically clean—just as it comes from the plating bath. *Water Dip #33 prevents finger printing and staining during assembly, storage and use.*

IF YOU'RE DOING COPPER PLATING, you can cut out extra operations by using Water Dip #33. Work goes *directly* from the last hot water rinse into Water Dip #33—no need for rehandling and drying.

IF YOU'RE USING COPPER-PLATED PARTS, you will find that you can make excellent soldered connections, and you can make strong, uniform welds even after the parts have been dipped in Water Dip #33.

Water Dip #33 has many more advantages — in many types of plating. For the complete story, write for Technical Data Bulletin #117 or let our M & W technical consultant discuss your requirements privately with you.

PIONEERS IN PROTECTION

OUR 78th YEAR

M & W CO 1874

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UNICHROME
Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Specifications on corrosion resistance met by these
Two Ways to Chromate-Finish Zinc

Primer protection for light metals

Unichrome Primer AP-10 offers the two properties that insure durable finishing of magnesium, aluminum and other metals. (1) Great resistance to corrosion even by itself. (2) Strong adhesion even under tough service conditions. That's why it actually improves the life of finish coats. For example: Magnesium panels were primed with AP-10; others with a standard primer. All were given identical finish coats and then tested in salt spray. After 100 hours, panels with Primer AP-10 had developed no corrosion, whereas the others had failed completely.

CLEAR ENAMEL SAVES THOUSANDS OF DOLLARS

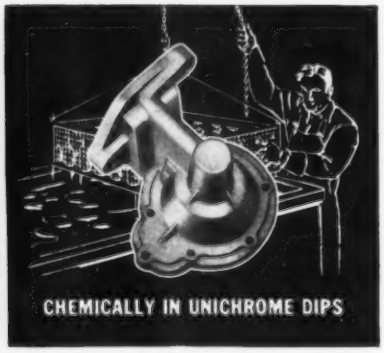
A clear enamel over today's decorative chromium finish gives extra protection against moisture, handling, corrosives. Using a special Unichrome Coating, one well known manufacturer is getting not only superior protection on plated refrigerator shelves, but also twice the film thickness at half the cost of the coating formerly used. Savings reported for the year: $15,000.

Better Protection Against Chemical Attack

Because Ucilon* Protective Coatings resist many strong chemicals, they're being used today in a wide variety of tough applications. On plating machines, for example. Also on bottling machines and on processing equipment. Use of these coatings means less corrosion and better appearance with less maintenance. Ucilon Coating Systems are available to withstand acids, alkalies, salt solutions, oxidants, moisture, petroleum products, alcohols, fumes and other corrosives. Write for Bulletin MC-4.

*Trade Mark

ELECTROCHEMICALLY IN "ANOZINC"


CHEMICALLY IN UNICHROME DIPS

■ Government specifications which call for chromate treating of zinc plate, do so to assure protection against corrosion. Several methods of chromate finishing are available to do this job. This gives the user freedom to choose the particular process that's best suited to his product, and offers production or cost-cutting advantages.

Two Unichrome Processes are widely used today because they can not only meet or exceed specifications, but also provide substantial benefits to the user.

A TOUGHER COATING THROUGH ANODIZING

The Anozinc* process, using conventional plating equipment, produces black, yellow or clear chromate type coatings on zinc plated parts by means of current. An exclusive process, it provides a finish with not only the desired corrosion resistance, but also superior toughness while still wet. This means that parts can be handled at once, thereby minimizing the storage and drying space problem.

The Anozinc process can be set up in one continuous automatic cycle with the zinc plating, or for manual operations. Zinc plated steel shell cases are being turned out at a fast clip with this process, as are propeller blades and other vital work.

In forming conversion coatings, chromate treatments remove some of the zinc from the product. Consequently, there is a problem in recessed areas of the work, where zinc plates thinner than it does at the edges. Not with Anozinc, however. An anodizing process, it complements the zinc plating process. Its stripping action is less in recesses where the zinc plate is thin. With a straight chemical dip, more zinc would have to be deposited to compensate for non-selective stripping action.

UNICHROME DIP A SIMPLE PROCESS

Unichrome Dip Finishes, chemically produced, are adaptable for manual or automatic operation. They too inhibit corrosion and withstand exposure. Different solutions produce a black, olive drab, brass-yellow, iridescent yellow or clear chromate coating in 5 seconds to 2 minutes, depending on the solution used. These finishes, integral with the zinc surface, also make excellent bases on which to apply organic coatings.

As straight chemical processes, Unichrome Dips use simple equipment, need no generator or rectifier and minimize installation costs.

Unichrome Dips produce bright, glossy finishes. The black and olive drab finishes can provide the eye appeal of glossy enamel. Clear finishes are bright, and have an appearance similar to chromium.

BOTH ARE ECONOMICAL SOLUTIONS

Anozinc baths have exceptionally long life. Unlike chemical dips, they seldom need to be discarded. In mass production, this feature cuts operating expenses.

Compared with other dips, Unichrome Dips can save money, too. By using a Unichrome Dip instead of their "home made" chromate dip, one well known company cut cost of materials alone by one-third.

Write for Bulletin CC-1, or phone the nearest United Chromium office.

UNITED CHROMIUM, INCORPORATED

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Chicago 4, Ill. • Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

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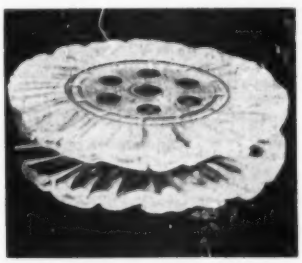
PMM NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

VENTILATED BUFF PERMITS FASTER BUFFING

Ruff-L-Buff
Hanson-Van Winkle-Munning Co.



SPECIAL FEATURES: Faster buffing and longer buff life claimed due to special buff construction; designed for self-ventilation. Ventilating air enters wheel through holes in fibre-board centers of the buffs. As the wheel rotates, centrifugal force drives air through 12 channels between each buff where numerous ruffles distribute air through wheel, cooling as it goes. This permits faster wheel speeds and greater pressures between work and wheel.

SPECIFICATION: Cloth used in buffs is cut diagonally to the threads, exposing work to maximum number of thread ends. "Bias" construction eliminates ravelling. Buffs perfectly balanced for uniform rotation & wear; steel-ring anchor to secure cloth to fibre-board center; Red-E-To-Use face takes composition immediately without necessity of evening buff surface & impregnating it with composition.

Available in standard & heavy duty weights with OD's of 12, 14, 16 and 18". Non-standard sizes on request.

For additional information circle No. 196 on Reader Service Card

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CLOSED-FLAME, GAS-OIL BURNER SIMPLE TO INSTALL

Eclipse Fuel Engineering Co.

SPECIAL FEATURES: Closed-flame, dual fuel, gas-oil burner features increased burning efficiency, simplified installation and servicing. Excellent flame retention and mixing qualities for gas; increased atomizing efficiency for oil.

SPECIFICATIONS: Sealed, blast burner used with any gas or oil for industrial furnaces & process equipment between 200F and 2400F.

Unique nozzle mixing principle employes dual atomizing oil tip. Secondary air meets gas or oil mixture in both converging and rotating pattern.

Rotating main combustion casting permits adjustments for any desired alignment of piping. High discharge capacity, low turn-down range; blocks interchangeable with those of conventional burners; full range of sizes from 3gph — 105 gph.

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PEDESTAL TOOL GRINDER HAS MORE WORK ROOM AT WHEELS

Pedestal Tool Grinder
South Bend Lathe Works

SPECIAL FEATURES: By placing motor in protected area beneath pedestal, and removing it from between grinding wheels, more work space is allowed around wheels. Access from all angles permitted with cramping. Vibration is almost completely eliminated and motor is protected from abrasive dust.

SPECIFICATIONS: Grinder comes with either 8" wheels and ¾ hp motor with 10" wheels and ½ hp motor. Measures 49½" high, 18½" wide and 20½" deep.

Design removes weight of grinding wheels from the motor bearings; grinding wheel spindle runs on sealed ball bearings which, combined with fully-enclosed V-belt drive, produces a quiet, vibration-free running condition.

Large size eye shields make it unnecessary for operator to lift shield to see what he is doing. Extra large wheel guard castings have large dust outlets for hooking into dust exhaust system.

For additional information circle No. 198 on Reader Service Card

continued next page

HOW IS YOUR METAL-WASHING MACHINE WORKING?
DO THE NOZZLES CLOG TOO OFTEN?
IS THERE TOO MUCH FOAMING?
EVERYTHING IS OK! WE ARE GETTING OAKITE SERVICE

Is your washing machine removing buffing compounds as thoroughly as it removes cutting oil and metal chips?

Is it cleaning brass, aluminum and zinc die castings as well as it cleans steel?

Oakite chemists and service engineers have developed cleaning materials that meet every requirement for washing metal by machine. Oakite Technical Service Representatives know how to make these materials work at top efficiency in all types of machines.

Years of Oakite experience are compressed into a 16-page booklet called "*8 things to look for when you wash metal by machine*". You'll want to read the notes on:

- ¶ How to select the best detergent for each job. *See pages 4 to 6.*
- ¶ When to use a solvent detergent. *See page 7.*
- ¶ When to use an alkaline detergent. *See page 8.*
- ¶ How to prepare metal for painting. *See page 9.*
- ¶ Tips on selection and operation of washing machines. *See pages 10 to 12.*
- ¶ Special instrument aids to better operation. *See page 13.*

FREE For a copy of "*8 things to look for when you wash metal by machine*," write to Oakite Products, Inc., 34G Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. & Canada

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BLIND HOLE TAPPING LUBRICANT

Hypertap
Destiny Products Co.

SPECIAL FEATURES: Stick-lubricant placed in blind holes to be tapped is said to permit use of finishing or bottoming taps without preliminary tapping. Blind hole lubricant provides automatic-hydraulic chip removal during cutting.

SPECIFICATIONS: "Hypertap" stick, same diameter as hole, is inserted prior to tapping; tap is then brought down into cutting action. In its descent through the hole, the tap exercises pressure on lubricant, causing it to envelop the chips and force them up alongside the flutes of the tap, and out of the hole.

Lubricant is non-corrosive, water-insoluble, stable in storage, withstands temperatures below 100F. Sticks furnished in any specified diameter. Current production ranges from 9/64" to 1" diam., with standard lengths 3½" and 7½".

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HIGH-SPEED HAND TOOL FOR GRINDING, DEBURRING

Diskette, Model B-2
Franklin Balmar Corp.

SPECIAL FEATURES: Portable, electric, hand tool designed for high speed grinding, filing, deburring, sharpening, sanding, polishing. Since it operates at higher speeds than conventional electric tools, its capacity is limited to 4" discs.

SPECIFICATIONS: Universal motor for 110-120 AC/DC current gives spindle shaft a no-load speed of app. 9000 rpm's. High grade ball bearings; air intake casting of aluminum provides greater intake area for cooling air; double cooling fan.

New model incorporates collet chuck in the spindle for all attachments. Where used with composition discs, a special threaded adapter collet is available.

For additional information circle No. 200 on Reader Service Card

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BUFFING GUIDE FOR SHOP FOREMEN

Pocket Calculator & Buffing Guide
American Buff Co.

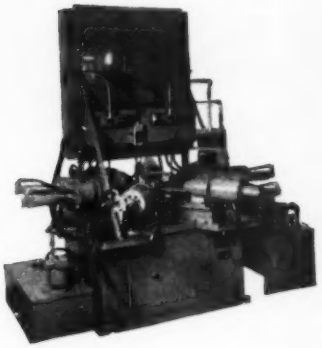
SPECIAL FEATURES: Offered free by American Buff Co., this slide-rule type device helps in making buffing decisions on all types of jobs. Answers such questions as: what type of buff is required for polishing aluminum die castings; what diameter wheel produces a certain surface speed, etc.

Handy tool in plastic case fits into shirt pocket; has simple directions printed on the case. Helps shop man find right buff, right size and right speed for each buffing job.

To obtain free Buffing Calculator, Circle No. 201 on Reader Service Card.

MACHINE DRILLS 3840 HOLES PER HOUR

Govro-Nelson Co.



SPECIAL FEATURES: Machine drills 32 holes of 3.16" diam. in steel at rate of about 120 pieces per hr.

SPECIFICATIONS: Machine is built of 8 Model HH Govro-Nelson automatic drilling units electrically interlocked with automatic hydraulically operated clamping and indexing.

In operation, the operator places the part on the fixture and presses start-cycle switch. Part is automatically clamped and 8 holes drilled simultaneously at each of four indexes, thus completing the 32 holes. Part is then automatically unclamped

Circle No. 202 on Reader Service Card.

MOLYBDENUM SPRAY COAT

Molykote M-88
The Alpha Corp.

SPECIAL FEATURES: when heavier, longer-lasting dry lubricating films are needed, this new dispersion of near-colloidal particles of Molykote molybdenum powder combined with organic binder in volatile solvent may be used.

SPECIFICATIONS: Applied to clean surfaces by spray, brush or dip. Solvent evaporates leaving tenaciously bonded coating of .0003 to .0007 thickness. Maximum uniformity obtained if spraying is done while surface is heated to 300 F.

Circle No. 203 on Reader Service Card.

THE SKY'S THE LIMIT IN SAVINGS WHEN YOU *Roto-Finish* PRECISION PARTS

Tedious, hand or semi-mechanical finishing of precision parts takes time . . . costs money. With the original Roto-Finish process, using Roto-Finish machines, chips and compounds, one man can finish hundreds of parts *at one time* . . . to exact tolerances. The illustrated parts show the diversity in *size*, shape and material in the parts that are *now* precision finished by the Roto-Finish process.

To determine your requirements Roto-Finish maintains a completely equipped laboratory which can (and does) process parts to your specifications. The results we obtain are guaranteed to be duplicated in your plant. This sample processing service is yours without obligation. Just send a few unfinished parts . . . along with a finished part as a guide, for prompt recommendation of the correct Roto-Finish process that exactly fits your requirements.

write for fact-packed Catalog

Inquire about Roto-Finish Special Machines and Equipment for specific applications.

Roto-Finish COMPANY

associated with The Sturgis Products Co.
3716 MILHAM ROAD, KALAMAZOO, MICH.

P. O. Box 988—
Phone 3-5578

FOREIGN REPRESENTATIVES: CANADA — Windsor — Roto-Finish Canada Limited • ENGLAND — London — Roto-Finish Limited — 39 Park Street — Mayfair • AUSTRALIA — Melbourne — A. Flavell Pty, Ltd. • HOLLAND — Delft — N. V. Roto-Finish Maatschappij — Rotterdamse — WEG 370A • AUSTRIA, GERMANY, SWITZERLAND — Frankfurt a.M. — Metallgesellschaft A.G., Germany • ITALY — Milan — Societa Roto-Finish a R.L. — Sesto S. Giovanni — Viale E. Marelli 31 • FRANCE — Paris — Societe Roto-Finish, 70 rue de la Republique-Puteaux (Seine) • BRAZIL — Rio de Janeiro — Commercial E. Industrial de Formas Werco, Ltds.

For additional information Circle No. 46 on the Reader Service Card

PARKER-KALON®

The Original

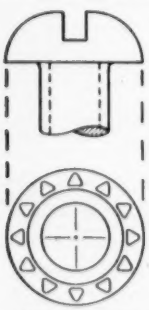
SELF-TAPPING SCREWS

NOW...

Signed

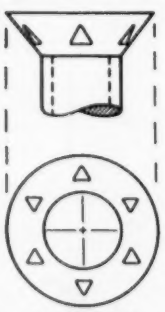
For Your Protection

NON-COUNTERSUNK HEADS



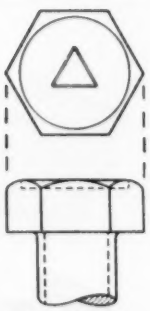
12 IMPRESSED TRIANGLES UNDER HEAD

COUNTERSUNK HEADS



6 IMPRESSED TRIANGLES UNDER HEAD

HEXAGON HEADS



1 EMBOSSED TRIANGLE ON TOP OF HEAD

Signed Like the hall mark on fine silverware, this triangle mark now impressed on all P-K Self-tapping Screws signifies the maker's pride of craftsmanship. This "signature" will serve for your protection against substitution.

Certified Now, the P-K triangle mark will certify every screw that bears it as a genuine Parker-Kalon Product, made by the *originators* of Self-tapping Screws. Now, you can be sure, when you see this mark, that you are using the *only* Self-tapping Screws made with the accumulated "know-how" of 40 years of enterprising leadership.

Guaranteed Now, identification goes beyond boxes or other containers and labels. The screw identifies itself, and when you see the P-K triangle mark you know it is the *guaranteed* screw, backed by the "Guarantee of Highest Quality" printed on every box. Look for the P-K triangle on the screws you buy and use. It's your one sure way to guard against job-slowing, parts-wasting screw failure . . . the way to make *planned* assembly savings *pay off*.

Parker-Kalon Corporation,
200 Varick St., New York 14.

IF IT'S P-K IT'S O.K.

TRADE MARK REG. U.S. PAT. OFF.

For additional information Circle No. 32 on the Reader Service Card

PMM USEFUL LITERATURE

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

PROCESSES

Brass Die Castings Compared to Sand Castings & Forgings: No. 144

A technical brochure from Titon Metal Mfg. Co. makes a comparison between brass die castings & sand castings or forgings. It also tells how brass die castings are made at its plant, and gives a table of compositions & properties of the brass die casting alloys Well illustrated.

Case History Book on Plaster Mold Castings: No. 145

A booklet published by Ohio Precision Castings, Inc., devotes eight pages to detailed case history reports illustrating use of plaster mold castings in machines, motors, photographic equipment and for experimental work. Includes page of alloy specs.

Investment Casting — Advantages, Uses: No. 146

Detailed information about the invesment casting process has been made available by The International Nickel Co., Inc. in a booklet entitled, "Investment Casting — Its Advantages and Practical Applications."

Three Articles on Investment Casting: No. 147

Reprints of three technical articles on investment casting, bound together and punched for looseleaf, are offered by Howard Foundry Investment Casting Div. Papers include: "Foundry Methods Improve Investment Castings," "Investment Castings: Requirements for Design for Proper Casting," and "How to Prepare Metals for Precision Casting."

MATERIALS & EQUIPMENT

Crucible for Melting Magnesium: No. 150

Recent developments in steel fabricated crucibles for magnesium melting are reported in a new illustrated brochure offered by American Tank & Fabricating Co.

Colloidal Graphite for High Temp. Lubrication: No. 151

Bulletin No. 423 from Acheson Colloids Co. is devoted to the use of colloidal graphite as a high temperature lubricant. Many applications in the metal working field, including die casting die lubrication, are included.

How to Back Up Shell Molds: No. 151

The use of metal shot as a weighting or back-up material in shell molding is the subject of technical bulletin in No. 5 from the Harrison Abrasive Div. of Metals Disintegrating Co., Inc. Complete process details are described, background information to be considered is presented, and several drawings are used for illustration.

Complete Line of Carbide Dies: No. 152

A new 30-pg catalog from Carboloy Department of G. E. describes a complete line of carbide dies including wire flattening rolls, welding rod coating dies, round hole dies, shape dies, mandrels extrusion dies, blanking dies, etc.

Resin Core Binders: No. 153

Publication of a booklet, "Cyacor Resins — Their Use As Core Binders," has been announced by American Cyanamid Company's Plastics Department. The two types of resin core binders are reported to speed up core production as much as 50% in the sand casting & semi-permanent mold operations.

Continuous Chip Removal: No. 154

A special type of conveyor for continuous removal of hot, wet or dry chips is presented in a 4-pg illustrated bulletin from May-Fran Engineering Inc. Eliminates periodic shutdown for scrap removal.

Screw Thread Inserts: No. 155

The second edition of "The Heli-Coil" gives a number of case history reports on the use of Heli-Coil screw thread inserts to protect threads. It also has a brief report on the increasing trend toward the use of magnesium die castings. It is published by Heli-Coil Corp.

Pneumatically Operated Valves for Vacuum Processes: No. 156

A data sheet from Distillation Products Industries reports on pneumatically operated valves for remote to automatic control of high vacuum processes.

Tungsten Carbide Catalog: No. 157

In a new 72-pg general catalog, Metal Carbides Corp. shows its complete line of tungsten carbide products including cutting rolls, draw dies, bushings, gages, diamond wheels and wheel dressers and solid carbide stock.

Small Hole Grinder Useful for Die Work: No. 158

Featured in a new catalog from Rivett Lathe & Grinder, Inc., is a small hole grinder of special interest to tool & die men. Interchangeable wheelheads make this unit readily convertible for internal or external grinding.

Inserts Provide "Ready Made Tapped Holes": No. 160

Screw locking inserts to provide "ready made tapped holes" in blind holes in castings, plastics and other materials are clearly explained and illustrated in a new brochure from Brush Nail Expansion Bolt Co.

FINISHING

Automatic Washer for Paint Spray Masks: No. 165

Just released by Finish Engineering Co., Inc., is a folder illustrating their automatic mask washer for paint spray masks. Cutaway diagrams reveal the operation of the unit, while description gives both the operating and construction advantages.

Price-Tips on Plating & Polishing Supplies: No. 166

A new monthly publication introduced by Wagner Brothers, Inc., contains price information on all plating & polishing supplies & standard equipment distributed by Wagner Bros. It also carries news on plating industry developments.

Hundreds of Rotary Tools: No. 167

Publication of a complete catalog by M. A. Ford Mfg. Co. has been announced. It illustrates & gives specs for 363 shapes & sizes of high speed steel rotary files, ground cutters, countersinks, rasps, carbide cutters, end mills and grinding burrs.

How to Clean Aluminum: No. 168

Current issue of Reynolds Metals Technical Advisor (No. 20) includes a discussion of cleaners for aluminum. Reported are solvent alkaline & acid cleaners, as well as precleaning for resistance welding.

Grinding Machine Dogs: No. 169

Grinding machine dogs and accessories are the subject of a new brochure received from Ready Tool Company.

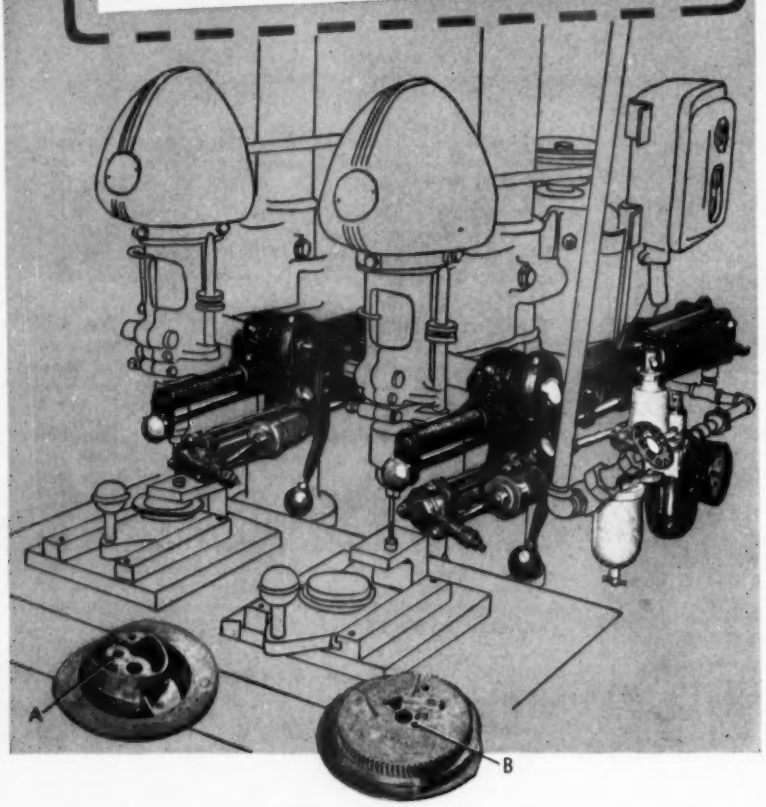
Industrial Washers: No. 170

An 8-pg booklet from Detrex Corp. describes in detail their complete line of industrial washers ranging from single-stage totally enclosed cabinet washers to huge, 5-stage phosphate coating & paint bonding machines.

Automation For Finishing at Ford Plant: No. 171

Feature editorial presentation of the first issue of "Finishing Engineer" published by Metalwash Machinery Corp. is a photographic report on the use of automation in the new Ford Motor Company engine plant in Cleveland. Stressed is the application of automation for washing operations.

When Joe cut labor costs 65%
on this die cast reaming operation
he earned more than a pat on the back



THE JOB: Finish ream two holes in a zinc die cast record changer part. Hole "A" on one side of the part, hole "B" on the reverse side.

JOE'S SOLUTION: He equipped two 14" drill presses with Bellows "Controlled-Air-Power" Feeds and Hydro-Checks; installed a two-position fixture (load and unload in the front position, ream in the back position.)

THE RESULT: Labor costs cut 65%.

LIKE TO KNOW HOW JOE DID IT?

● That's what alert production men like about Bellows "Controlled-Air-Power" Devices. They spark imagination; set the old creative bug working; give an engineer ideas . . . and, equally important, help him put them to practical, profitable use.

Bellows "Controlled-Air-Power" Devices (air motors, air-powered work and tool feeds, air-operated rotary work feed tables, air-powered work holding and clamping units) convert standard hand-operated machine tools to automatic units, make tool-room built special purpose machines practical and inexpensive even for short runs.

Write for Foto Facts File 46-396. We'll send it, without cost or obligation, along with many other similar factual stories . . . full of ideas you can use to cut costs on secondary die cast operations. *Address: Dept. PMM 253.*

1129

The Bellows Co.
AKRON, OHIO

For additional information Circle No. 45 on the Reader Service Card

PROMOTIONS and APPOINTMENTS

FRANK R. ADAMS has been appointed field engineer in the Saginaw, Mich., area by *The Bellows Company,* manufacturers of "Controlled- Air-Power" devices.

ALLEN W. MATHIS, JR. has been elected vice president of *Club Aluminum Products Co.* of Chicago.

DONALD O. DICE has been appointed vice president and sales manager of *C. M. Hall Lamp Company* of Detroit.

DR. AMOS J. SHALER, associate professor of metallurgy at Massachusetts Institute of Technology, has been named professor and chief of the division of metallurgy at the *Pennsylvania State College.*

G. GERALD MISENER has been appointed purchasing agent for the *Harper Electric Furnace Corp.*, Buffalo, N. Y.

HAL R. SHEAFFER has joined the staff of *Metals Disintegrating Co., Inc.* of Elizabeth, N. J., manufacturers of metal pigments, metal powders and metal abrasives. His new post will be manager of pigment development.

R. M. HORNBECK has been appointed vice president in charge of purchases by *Westinghouse Air Brake Company,* Pittsburgh.

R.A. LINDSAY has been appointed to the staff of Technical Service and Development for *The Dow Chemical Company.*

Appointment of works managers for the two Toledo, Ohio, plants of the *Doehler-Jarvis Corp.* has been announced. They are JOHN W. THEES, formerly manager of Doehler-Jarvis' Chicago plant, to be works manager of Toledo plant No. 1, and CHARLES I. HODGSON to be works manager of plant No. 2.

REFERENCE MATERIAL, catalogs and data offered free in this month's ads (circle numbers on reader service card.)

2. PRECISION CASTINGS from frozen mercury patterns described in bulletin from Alloy Precision.

7. SHELL MOLDING is described in a booklet published by Bakelite.

8. DIE CASTING MACHINE catalog showing complete line of equipment is offered by Cast Master.

9. DIE CASTING MACHINE specifications are available in catalog from Cleveland Automatic Machine Co.

11. DIE CASTING MACHINES to produce 800 shots per hour are presented in catalog from DCMT.

13. SMALL DIE CASTINGS from specialized departments of Dollin Corporation are featured in a booklet.

15. SINTERING EQUIPMENT for powder metallurgy, along with hardening equipment, is the subject of latest catalog from C. I. Hayes.

16. DIE CASTINGS is title of a booklet describing the facilities of Hoover Co., Die Casting Div.

17. INVESTMENT CASTINGS—when to specify and when not to specify them — reported in 4-pg brochure from Howard Foundry Co.

19. PROPERTIES of NEW ALLOY of aluminum are listed in brochure on Almag 35 from Wm. Jobbins.

20. SAFE OPERATING TEMPERATURES for hydraulic fluids in die casting machines by use of heat exchangers is discussed in Kewanee-Ross booklet.

21. DIE CASTING MACHINES are the subject of an illustrated catalog from Kux.

22. TWO-CHAMBER MELTING furnaces are presented in bulletin from Lindberg Engineering.

24. NON-FLAMMABLE FLUID for die casting machines reviewed in 12-pg booklet on Pydraul F-9 from Monsanto.

30. STEEL-BELTED PISTONS for all types of engines are subject of data-book from Thompson Products Light Metals Div.

31. BARREL FINISHING equipment, accessories & supplies are contained in complete catalog from Grav-I-Flow.

33. TWO METHODS for applying chromate finish to zinc are subject of bulletin from United Chromium.

36. CUSTOM ALLOY POWDERS for alloy steel compositions are discussed in detail in technical literature from Metal Hydrides.

38. FACILITIES FOR PRODUCING powder metal parts & review of the scope of powder metallurgy from Michigan Powdered Metal Products.

39. ALUMINUM CASTINGS with attractive Velva-Glaze finish reported in booklet from Monarch Aluminum.

40. DIMENSIONING DIE CASTINGS is subject of a guide book from Newton-New Haven Co.

42. POWDERED METAL PARTS, their production & uses, are described in bulletin from Powdered Metal Products Co.

44. IRIDITE PROTECTIVE systems for corrosion-resistant metal surfaces are outlined in brochure from Allied Research Products.

45. AIR CYLINDERS — diagrams, complete specs, detail drawings — are the subject of a 32-pg brochure from Bellows Co.

46. PRECISION FINISHING by means of barrel techniques are discussed in detail in Roto-Finish Co.'s new catalog.

48. ZINC & ALUMINUM die castings produced by Advance Tool & Die Casting Co. are introduced in new booklet.

50. CENTRIFUGAL INVESTMENT castings produced by Electronicast are the subject of a folder telling about the process of its applications.

51. ZINC ALLOY SUPPLIERS Henning Bros. & Smith offer a monthly house organ called The Henning Messenger.

53. HOW TO DESIGN aluminum & magnesium die castings is the subject of a data book from Litemetal Dicast.

58. PLASTIC PATTERNS for investment casting produced on injection machines presented in catalog from Van Dorn.

59. FOUR BASIC BARREL sizes to do almost every type of barrel finishing are covered in literature newly published by Abbott Ball.

60. WET SANDING WITH DISCS using new type pad is introduced in literature available from Carborundum Co.

61. BARREL PLATING using multiple unit equipment designed for small batches, is presented in a catalog from Daniels Plating Barrel.

62. KEEPING COPPER BRIGHT and chemically clean by means of new type water dip is subject of brochure from Maas & Waldstein.

63. HOW TO DRY plated work & small lacquered pieces by a spin-dry method is described in 4-pg booklet from New Holland.

64. EIGHT THINGS to watch for when you wash metal by machine is title of informative brochure published by Oakite.

65. ALLOYS FOR INVESTMENT casting are described in literature from Cannon-Muskegon.

continued next page

For additional information Circle No. 84 on the Reader Service Card

HERE'S THE
"tap miser"
YOU'VE BEEN WAITING FOR!

with the new "TRU-GRIP" tap holder

Helps eliminate costly tap breakage shut-downs and excessive work spoilage!

Breaking too many taps?—Tap life shortened?—Spoiling many pieces?—Then check your tapping equipment. Investigate PROCUNIER Tapping attachments. Whether it's continuous or intermittent tapping in soft or hard metals—large or small hole jobs with skilled or unskilled operators—you will find Procunier Tapping machines performing with a new-found ease, a more dependable and consistent accuracy and providing many extra hours of tapping efficiency.

Procunier Tappers include: cover clamping and quill models mount rigidly eliminating chatter and vibration; new, sensitive double-cone friction clutch automatically regulates driving pressure with a soft "cushioned" action; ballbearing; heat treated gears with special reversing mechanism; unique tap holding spindle support; aluminum housing; plus other important features.

Write today for more complete details and specifications

Procunier Safety Chuck Co.
14-16 S. Clinton St., Chicago 6, Ill.
Dept. 2

Please send your illustrated brochure giving complete details, specifications and prices on the improved line of Procunier High Speed Tapping Heads

Name .....
Address .....
City ..... Zone ....
State .....

The exclusive Procunier "Tru-Grip" tap holder is lighter, smaller in diameter. Eliminates "chewed" tap shanks.

PROCUNIER
SAFETY CHUCK COMPANY
14-16 S. CLINTON ST. CHICAGO 6, ILL.

72. STANDARD SINTERED BEARINGS from stock are listed in booklet from National Molded Products.

76. ELECTRIC FURNACES for melting high temperature investment casting alloys at rapid rate are introduced in literature from Detroit Electric Furnace.

77. JOB STUDY BROCHURE showing analysis of pieces being cast in plaster molds is offered by Ohio Precision.

78. REFERENCE FOLDER on a line of P-V investments for the investment casting process is offered by Pre-Vest.

80. HOW TO HEAT WAX for making investment casting patterns can be learned from literature available from Sta-Warm Electric.

84. HIGH-SPEED TAPPING heads are illustrated and described in literature from Procunier.

86. TOOLS FOR DIE WORK & a regrinding service are in "All Star" catalog from Severance Tool Industries.

88. BARREL FINISHING is discussed in a set of 3 booklets from Almco Div., Queen Stove Works.

89. FACILITIES FOR DIE CASTING are presented photographically by Republic Die Casting in a booklet which also displays many of the die castings produced.

90. SMALL DIE CASTINGS — review of size, alloys & design limits — in folder from Gries Reproducer.

DANIELS UTILITY BATCH PLATER

New multiple DANIELS PLATING BARREL unit designed to handle small lots of work economically. Unit consists of a multiple of small size barrels, each independent of the other. Individual removable tanks. Cylinders allow plater a wide range of cleaning, pickling and plating applications.

Send for complete details on this and other plating equipment.

DANIELS

DANIELS PLATING BARREL & SUPPLY CO.
MANUFACTURERS & DISTRIBUTORS
Electroplating and Polishing Equipment and Supplies
129 Oliver Street, Newark 5, N. J. • Tel. MArket 3-7450

For additional information Circle No. 61 on the Reader Service Card

W. O. SWEENEY JOINS ARWOOD PRECISION CASTING

The Arwood Precision Casting Corp. of Brooklyn, N. Y., has announced that on February 1, William O. Sweeney joined their organization as

assistant vice-president of sales. Mr. Sweeney has been sales and development manager of the Haynes Stellite Division of Union Carbide and Carbon Corp. He has been active in the American Society of Metals, Society of Automotive Engineers, American Foundryman's Association and American Rocket Society.

OUTBOARD BEARING
continued from page 50

painter can simplify his most awkward painting job.

A special core in the die casting die is used to produce this internal thread. Industrial Tool & Die Company of Chicago who produce these die castings have built a die with a rotating core which rotates as the casting is ejected. This slows down the casting cycle somewhat, but saves the difficulty of a knockout core.

By means of a die casting, a one-piece construction has been permitted, as compared with two-piece wire and wood construction which calls for extra assembling. For an outboard bearing construction, using screw machine and formed wire, approximately four cents more per unit would be spent, due principally to an extra drilling and brazing sequence of operations. In a highly competitive market, this amount can be a critical difference between success or failure.

Simplified finishing is possible on the die cast aluminum handle. Although the castings are die-trimmed by the die caster, removal of the flash root is combined with all-over surface finishing by means of a wet abrasive blast treatment. This gives a pleasant, satiny finish to the aluminum and requires no coating or other protection. It is a type of finish which has been finding increased popularity for all portable tools and many household appliances recently. It is a low cost finish that has definite sales appeal on the retail counter.

Geared to Variety

MERRIMAN BROS., INC.

Originators of

SINTERED HELICAL GEARS

in Brass, Bronze, Steel

INQUIRIES INVITED

MERRIMAN BROTHERS, INC.

185 Amory St., Boston 30, Mass.

For additional information Circle No. 54 on the Reader Service Card

AUTOMOTIVE MAGNESIUM
continued from page 36

CORROSION — Generally speaking, a serviceable automotive part is not one which suffers no corrosion but rather one whose function is not impaired through corrosion even under conditions judged to be of the greatest severity. Considerable doubt was originally present as to the ability of magnesium to withstand the effects of the chloride road salt used throughout the winter in cities such as Detroit, Cleveland, etc. Cars operating in these localities are exposed to constant salt action for the four winter months. Results after approximately three years service clearly indicate that corrosion of the magnesium, under exposure encountered by road salts and in locations such as the underside of the car, is not of sufficient severity to restrict its application. Tests were conducted on unpainted castings with no attempt to insulate galvanic action from contact with iron, steel, or copper alloys.

Service test data were also obtained on parts exposed to action of very corrosive fluids such as coolants and brake fluids. Results clearly indicated that, unless protective chemical treatments or coatings could be supplied, magnesium could not be utilized in such applications.

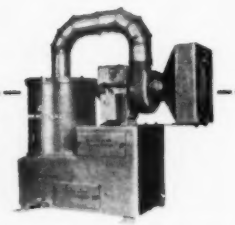
With regard to painted magnesium castings used in decorative or functional parts such as steering column shrouds, fold top pillars, etc., no instances of undesirable corrosion have been encountered in over two years production service.

STRESS—Some of the castings presently released for production must carry high static and fatigue loads. After a considerable period of car testing under the most severe conditions and part testing in the laboratory we have reached the conclusion that magnesium and aluminum can be released as optional materials for a particular design. It has further been found that the design modifications necessary to change a cast iron part to magnesium are not of sufficient magnitude to prevent obtaining the full weight reduction as anticipated from specific gravity comparison. A possible exception to these general statements would be in the case of a part where deflection was the major consideration.

WEAR—While magnesium has always been praised as an excellent bearing material and undoubtedly is, some adverse factors have been experienced in running steel valves, shafts, etc. in cast magnesium parts. It appears that when loads are high the magnesium will develop a rapid wear pattern and that the metal is particularly

Why it pays to SPIN-DRY plated work—small lacquered parts

Choose from 3 carefully engineered models . . .



1. **Standard Model.** Takes nearly every type of part. Built for long, trouble-free service.

Saves time . . . With the New Holland Kreider Dryer operating at 625 r.p.m. on only ¾ h.p. you can *spin-dry* a basket of parts (1140 cu. ins.) in as little as 35 seconds—no more than 2 minutes.

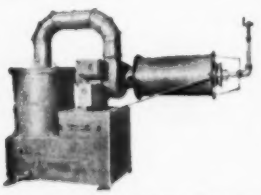
Improves quality . . . With a New Holland Kreider Dryer, high speed centrifugal spin-drying eliminates scarring and marring, assures smooth evenly dried surfaces, with longer lasting luster . . . fewer "rejects."

Cuts costs . . . What's more, though a New Holland Kreider Dryer occupies less than 6 sq. ft. of floor space, it's a big money saver. Power costs are low, production high—with little or no maintenance over years. And one man can operate it, easily, efficiently.

See for yourself. Write Department PR-253 today for illustrated 4-page folder . . . also addresses of installations near you.

New Holland Machine Co., New Holland, Pa.

2. **With Auxiliary Steam Heating Unit.** Used for small parts that hold moisture—lacquered parts—or where cold water rinse is used.



3. **With Auxiliary Gas Heating Unit.** Used for small parts. Caution: Do not use with inflammable materials.

NEW HOLLAND KREIDER DRYER

For additional information Circle No. 63 on the Reader Service Card

susceptible to abrasion and scratches from dirt or sharp corners. It also seems that adequate lubrication must be supplied where steel is running in magnesium at high speeds to avoid seizure. We believe, therefore, that some form of hard surface coating will be necessary in many applications to prevent undue wear.

FABRICATION— No dissertation on magnesium service experience would be complete without a few words with regard to production fabrication. Probably the most important property of which magnesium can boast is that of excellent machinability. Yet it is also a factor which inspires the greatest fear against the metal. After 1½ years experience with production machining magnesium, we can make the unqualified statement that no restriction on the usage of magnesium can be warranted by reason of the fire hazard encountered in machining. Tool life has been excellent, much higher than experienced with any other metal. Finishes have been all and more than expected, and many benefits are anticipated through the eventuality of specialized machines. At the present time, however, some rather important drawbacks exist with regard to machining magnesium as follows:

1) The necessity of using oil coolant for fine cuts rendering disposal of chips difficult; 2) The poor salvage and reclamation status for chip disposal, as compared to aluminum, is costly; 3) Parts are easily distorted in handling, clamping, and chucking.

It is recognized that these conditions are due to lack of familiarity and to the rather small volume of metal being processed in the automotive industry.

We sincerely believe, as a result of experience to date, that no serious objections have been encountered which would restrict the application of large volumes of magnesium to the automobile.

Produce
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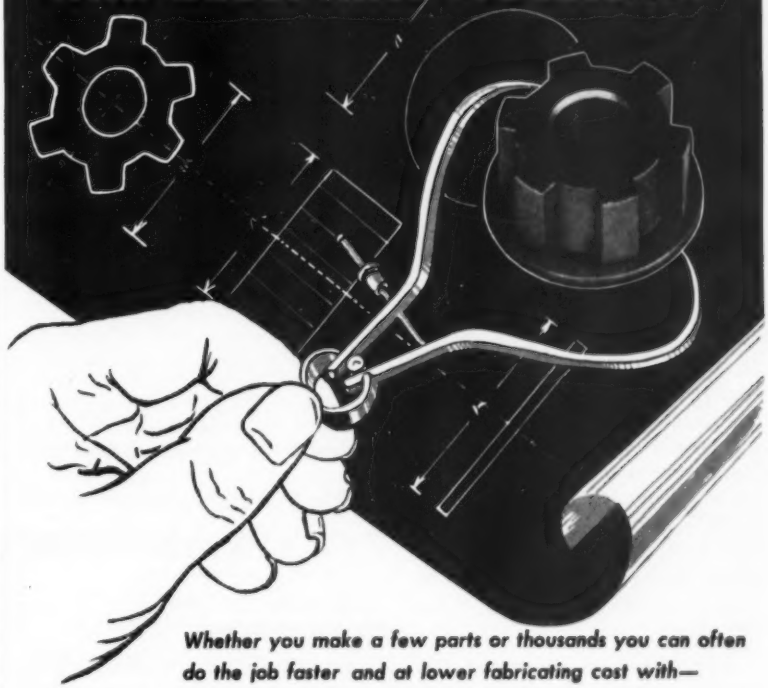

Whether you make a few parts or thousands you can often do the job faster and at lower fabricating cost with—

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Powder metal parts are economical. There's no waste metal. Unused powder after pressing can be used again.

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MD Metal Powders are dependable because they are the result of over 35 years of research and manufacture by MD, the pioneer in metal powder development.

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PMM INDUSTRY NEWS

AIME REORGANIZES POWDER METALLURGY GROUP

Powder metallurgy activities of the American Institute of Mining & Metallurgical Engineers is being expanded through the reorganization of its Powder Metallurgy Committee. The committee, which is now a sub-division of the AIME's Institute of Metals, is open to members or non-members.

Objectives stated in a recent announcement include: provision of a list of speakers to discuss various phases of powder metallurgy; provision of information and encouraging of meetings to make powder metallurgy better known; encouragement of research in the field; dissemination of news to interest more people in powder metallurgy.

Executive committee of the group consists of: J. J. Cordiano of U. S. Metals Refining Co.; J. C. Redmond of Kennametal, Inc.; J. F. Kuzmick of Welded Carbide & Tool Co., Inc.; H. H. Hausner of Sylvania Electric Products; Carl G. Johnson, Presmet Corp.; R. S. Busk of Dow Chemical Co.; and George A. Roberts of Vanadium Alloy Steel Co.

LITEMETAL DICAST ANNOUNCES SALES REPS

Litemetal Dicast, Inc., of Jackson, Michigan, has announced the appointment of James Gould of 470 Columbia Rd., Bay Village, Ohio, as representative for the company in the Northern Ohio area.

G. A. Wagner of 615 Sheridan Rd., Evanston, Ill., is again representing Litemetal Dicast in the Chicago area after an extended leave of absence.

BERYLLIUM AVAILABILITY IMPROVED IN 1952

A report from Lawrence P. Boland, sales manager of The Beryllium Corp., indicates a marked improvement in quantity of beryl ore available for commercial use. This is due both to an increase of mining activity, new deposits being worked, and the development of copper base alloys having lower beryllium content than the present high strength alloys.

These new alloys, it is reported, will provide sufficient strength or conductivity for many applications now employing higher beryllium content. They are not yet released to the trade.

Among the many applications in which beryllium alloys have achieved outstanding advantages are in the investment casting field, and more recently, in the production of molds and dies for plastics and die casting operations. Beryllium copper is one of the most readily castable alloys for fine-detailed, accurate-dimensioned and often complex-shaped investment castings.

PLANTS ANNOUNCE EXPANSION

REED-PRENTICE CORP. ENLARGES PLANT

Reed-Prentice Corporation of Worcester, Mass., recently completed a new factory building which provides 23,000 additional square feet of space for the assembly of large vertical milling machines. Besides vertical millers, Reed-Prentice manufactures engine and toolroom lathes, die casting machines, plastic injection molding presses and portable power chain saws.

NATIONAL CARBIDE DIE EXPANDS OPERATION

National Carbide Die Company of McKeesport, Pa., has announced completion of its recent expansion of floor space, and the addition of specialized personnel.

The company started as a two-man shop fabricating tungsten carbide dies seven years ago and is today a leading fabricator of the carbide tools used by the powder metallurgy industry.

The shop, headed by Clyde Holsing, averages more than 12 years experience per man in working with tungsten carbide. President of the company is T. A. Wilson who heads the engineering department. According to company statistics, the engineering department averages about 18 years experience per man in coping with design problems.

PRECISION METAL PRODUCTS BUILD NEW PLANT

Recent ground breaking ceremonies were held at the site of the new powder metallurgy plant of Precision Metal Products in Ellwood City, Pa. The company produces sinterings in bronze and iron, including bearings, machine parts and filters.

The company moved to Ellwood City in 1945, and its steady growth has resulted in decision to enlarge its facilities.

C. H. CURRIER DIES; CHAIRMAN OF BOARD KEWANEE-ROSS CORP.

Charles H. Currier, 66, chairman of the board of Kewanee-Ross Corporation, died suddenly on December 22, in Buffalo, N. Y.

Mr. Currier became chairman of Kewanee-Ross Corporation when Ross Heater & Mfg. Co., Inc., of which he was president, was recently joined with Kewanee-Boiler Corp. The new firm, also a subsidiary of American Radiator & Standard Sanitary Corporation, has

plants in Kewanee, Ill., Buffalo and Lebanon, Pa. Mr. Currier's office was in Buffalo. The firm manufactures Ross heat exchangers and surface condensers, Kewanee boilers and water heaters.

Mr. Currier became associated with Ross Heater & Mfg. Co., Inc. in 1934 was vice president. He had previously been president of Drying Systems, Inc. since 1927, and vice president since 1916.

INVESTMENT CASTINGS
continued from page 36

appearing casting was produced. After x-ray examination, which showed horrible results, and fracture tests were made, a condition called subsurface oxidation or burning was found.

Obviously, before sizable production runs could be made, this phenomenon had to be controlled or eliminated. After considerable research work was done it was found that, by the addition of a nonvolatile inhibiting compound to the investment mixture and development of a method to remove the oxygen from the flask after burnout, satisfactory investment castings of magnesium could be made. A considerable amount of this work was conducted in collaboration with engineers and research personnel of The Dow Chemical Company.

It was believed that the solving of this problem would result in a substantial amount of castings being made by this process. However, to date the quantity of castings made has hardly paid for or justified the

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Does your product occupy a prominent place on dealers' shelves? Has it gained profit-preference of dealers and earned first choice of users? You may gain the smoothness and precision needed to command preference in your market by using zinc and aluminum die casting techniques. Make use of ADVANCE specialized experience. Send us your drawings TODAY for a die casting survey.

ADVANCE operates under the CERTIFIED ZINC PLAN of the American Die Casting Institute.

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Company .....
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City .....(...) State.....

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great amount of work and trouble encountered in proving this process as a method of fabricating magnesium parts. At present we are at a loss to understand why the demand is so low but have not given up and are continuing our sales and promotional program.

The sizes and types of castings currently being made by this process represent, mainly, the aircraft industry and medical applications with a few commercial pieces. The largest piece here is about the extreme limit in both size and weight which is considered for this process. Dimensionally; depending on section thickness, tolerances of ± .005 of an inch per inch are usually held.

The alloy most generally used is Dowmetal C or American Magnesium Company AM 260. This is the 9 percent Al 2 percent Zn alloy which is heat treatable. This alloy is chosen because of its relative low susceptibility to intergranular shrinkage or microshrinkage. Since flask temperatures of about 600F are employed while casting, any tendency towards microshrinkage will be aggravated. Castings are currently being made to government and aeronautical specifications which specify that x-ray inspection be employed.

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PRACTICAL LUBRICATION SEMINAR

For the second consecutive year, a seminar on industrial lubrication engineering will be sponsored by the Philadelphia Section of the American Society of Lubrication Engineers.

Scheduled to start Tuesday evening, February 10, 1953, at Philadelphia's Bellevue-Stratford Hotel, the educational course will continue for four more consecutive Tuesdays, ending on March 10th.

The seminar will include detailed explanations and instructions on such subjects as lubricant dispensing equipment.

SHELL MOLDING
continued from page 36

orate has been found to be the best. When this inhibitor is used and when the gating of the casting is correct the burning can be virtually eliminated.

The inhibitor must be carefully chosen or it can result in a shell that will not stand handling. Boric acid, for example is an effective inhibitor as far as prevention of burning is concerned, but the shell mold is so weak that it can not be handled in the foundry.

Magnesium castings made in an inhibited shell mold show all of the desirable characteristics of other metals cast by this process; i. e. close dimensional tolerances and good surface at low unit costs.

OPPORTUNITIES

FOR SALE: Ajax electric furnace for aluminum, capacity 6-700 lbs.; 20 KW single phase 60 cycles; used 2 months only. Write Burlington Metal Products, Inc., 62 Brooks Ave., Burlington, Vt.

SERVICEMAN: Capable mechanic wanted for training as demonstrator & trouble shooter for die casting machinery. Experience with die casting process desirable. Weekly salary plus bonus for travel time. Write full details to E. C. Mast, Lester Phoenix, Inc., 2711 Church Ave., Cleveland, Ohio.

SALESMAN: Experienced in die & permanent mold castings is seeking high grade sources. Calling on manufacturers in Chicago area. Write box No. 2153, Precision Metal Molding magazine.

MEN with die casting or die casting inspection experience for supervisory position in Midwest die casting plant. Write giving experience & history. Box No. 2253, Precision Metal Molding magazine.

ESTABLISHED SALES representative covering Minnesota & Iowa interested in obtaining one additional line. Box No. 2353, Precision Metal Molding magazine.

NEW ENGLAND SALES AGENCY: A leading agency covering the metal working field in New England desires additional line of industrial parts. Preference: die castings, permanent mold castings, plaster mold castings, powder metal or plastic parts.

In addition to experienced sales engineers in the field, has competent engineering department. Only a producer of quality parts will be considered. Box No. 2453, Precision Metal Molding magazine.

PRECISION CASTING SUPERINTENDENT (now employed), 16 yrs. experience in investment casting, plaster mold casting, shell molding and conventional sand casting. Both ferrous & non-ferrous experience. Knowledge of investment formulae, raw material sources etc. Consider position on fee or consultation basis. Write Box No 2553, Precision Metal Molding magazine.

SALES ENGINEER with die casting or similar background wanted for Metropolitan New York & New England territories. Write Box No. 2653, Precision Metal Molding magazine.

DIE CAST SUPERINTENDENT: Plant with 100 employees, located in Cleveland, needs qualified man to supervise zinc and aluminum die casting operation. Must be able to handle operation of all departments. Write Box No. 2753, Precision Metal Molding magazine.

DEPENDABLE
BETTER METHODS
SUPER CAST
DIE CASTINGS
BETTER DIE CASTINGS
SINCE 1919

The meaning of a signature!

Through a quarter of a century of knowing how, the SUPER CAST reputation for Better Methods—Better Die Castings, has been recognized.

Sound engineering, metallurgical knowledge and skilled techniques have achieved and maintained a standard of superior quality.

SUPER CAST has kept faith, always deserving the mark it bears. SUPER CAST means die castings for those who want the best.

A sound, time-tested institution and a sound time-tested product have won confidence and widespread endorsement.

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BETTER METHODS
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THE SUPERIOR DIE CASTING COMPANY
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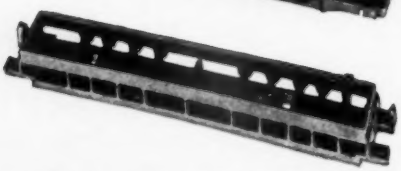
(NON—FERROUS)

PERMANENT MOLD, SAND, DIE CASTINGS

Our die casting division products require a minimum machining. Let our engineers solve your quantity production problems at attractive prices consistent with high quality.

FAMOUS PERKINS BRAILLER and some of the intricate parts die cast at HAMPDEN.



HB PATTERN SHOP, X-RAY & LABORATORY FACILITIES

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SHOT or INGOT!

For Investment Casting

MasterMet Certified Alloys are ready in Shot or Ingot form to suit your melting equipment. You can get Stainless, Super Stainless and Tool Steel Alloys in small quantities for sample runs or large quantities for Production runs in EXACT specifications.

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U. S. REDUCTION TO MAKE ZINC DIE CASTING ALLOYS

To offer a complete service to the die casting industry, U. S. Reduction Co. in their East Chicago, Ind., plant have begun making zinc die casting alloys.

Edwin A. Bergean, president of the company, has announced that they are producing USCO No. 3 and USCO No. 5 zinc die casting alloy in accordance with ASTM specifications, using only 99.99 percent slab zinc and USCO's special aluminum-magnesium hardener.

The U. S. Reduction Co. has been in the aluminum field for more than 48 years, and while it has plants in both East Chicago, Ind. and Toledo, Ohio, production of zinc die casting alloys will be carried on in the Indiana plant.

BEARING STANDARDS
continued from page 48

now available to provide complete standardization covering both iron-base and bronze-base metal powder oil-impregnated bearings.

The new Standard is designated 16-52T, "Specifications for Metal Powder Sintered Bearings (Oil Impregnated)," and is identical in substance to A. S. T. M. Standard B202 prepared originally by A. S. T. M. Committee B-9. By referring to both M. P. A. Standards it is now possible for all users of self-lubricating bearings to find complete industry-wide specifications in one place.

Both Standards are, under the regulations of the M. P. A. Standards Committee, subject to annual revision for a period of three years. Suggestions for revision should be addressed to the Association.

Copies of the Standards may be obtained at 25 cents per copy from the Metal Powder Association, 420 Lexington Avenue, New York 17, N. Y.

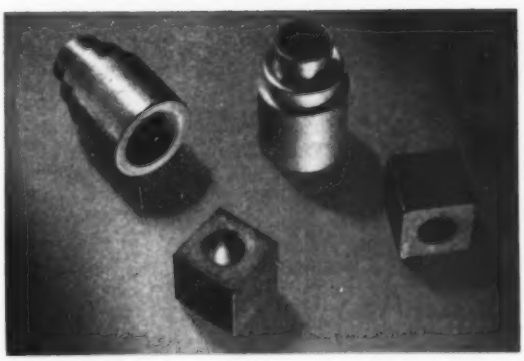
SIMPLIFIED SOLUTIONS

for production problems

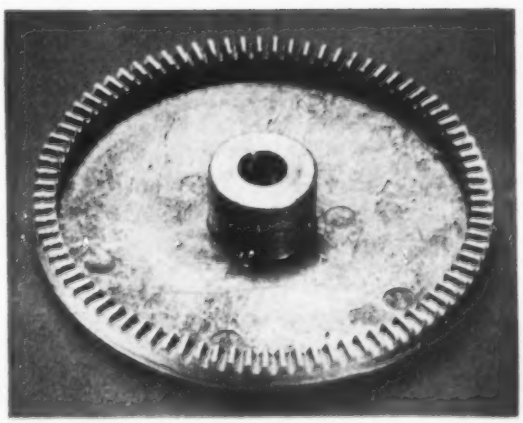
HIGH PRESSURE PUMP housings are normally sand cast with heavy walls or, where a lighter wall is required a forging may be used. This housing was specified in aluminum with a 5/15 thick wall, pressure tight at 1500 psi without impregnation, and pass 100 percent X-ray inspection. The complex internal configuration eliminated forging and the metallurgical and physical requirements precluded sand casting. As another one of the broad class of parts that can not be done in any other manner, the housing was cast in ASTM SC51A (Alcoa 355T6) by the Antioch process by Morris Bean Co. of Yellow Springs, Ohio. As cast the housing weighs 9 ½ lbs., is 11 inches in diameter and is pressure tested at 1500 psi. The physicals of a separately cast test bar of the same melt are:

	MINIMUM	TYPICAL
Tensile (ultimate)	32,000 psi	35,000 psi
Yield	20,000 psi	25,000 psi
Elongation	———	2 percent
Hardness (Brinell)	80	80

NON-STANDARD BEARINGS with special shapes or having special composition of metals are produced with ease by powder metallurgy. Two special examples of bearings produced for a business machine are these manufactured by Bound Brook Oil-less Bearing Company of Bound Brook, N. J. The tubular bearings are made of a special formulation to permit riveting or staking. The bearing is inserted through a punched hole in a sheet and staked over to make a permanent assembly. They replace heavily-machined bushings cut from free cutting brass bar. The square sinterings are also typical of non-standard shapes possible at lower cost with self-lubricating bearings.



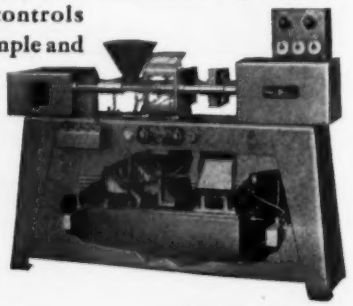
GOOD TOOTH CONTOUR at low cost is possible when quantities justify the building of a die casting die. This cup gear was originally designed as a zinc alloy die casting since the expense of cutting these teeth by machine would be far greater. The cast gear is produced by Midwest Die Casting Co. of Chicago, and features particularly clean tooth contours which are difficult to equal by machining, especially when width of the tooth face is only 5/64.



Investment Casters Prefer
VAN DORNS for
molding styrene patterns

Typical precision parts produced by investment casting, using styrene patterns molded to .300" tolerances on Van Dorn Presses.

Semi-Automatic Injection Press
—2-oz. capacity. This ultra-modern press has push-button controls that are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.



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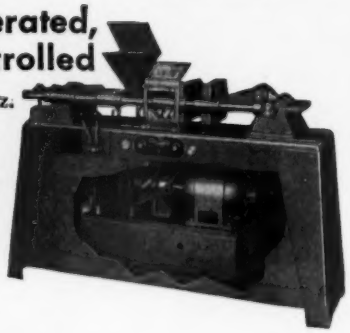
Power-Operated, Lever-Controlled Presses—2-oz. or 1-oz. models. Have many automatic and safety features.



MODEL H-200

Plastic Grinder—grinds up waste, rejects, etc., for re-use.

Mold Bases for these presses available from stock.

Write for information on this equipment.

MODEL G-100

THE VAN DORN IRON WORKS CO.
Cable Address: "VANDORN" Cleveland
2693 East 79th Street • Cleveland 4, Ohio, U.S.A.

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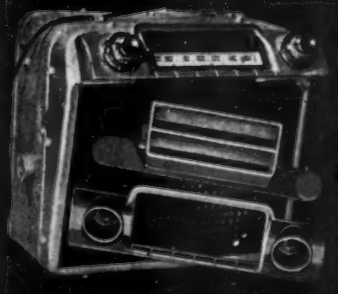
HOW TO GET THE MOST
continued from page 40

casting. If a drawn steel housing were to be used, an extremely complex brazing job would be required to secure the shaft bearings in a water-tight manner. To accommodate the various mounting components, detents and lock members without drilling rivet or screw holes in the housing walls was virtually impossible. A fairly heavy wall thickness would be required if the desired rigidity were to be secured. This would mean a material increase in weight as compared with aluminum and finally the corrosion resistance would be greatly reduced. Both brass and bronze presented all of the objections of steel, plus the higher cost. Corrosion resistance of bronze might be adequate, but certainly no better than aluminum.

Another pregnant reason for the use of a die casting was the ease with which raised letters and markings could be incorporated in the casting to a uniform height, an impossibility with any, other than a casting operation, method of fabrication.

Starting, then, with the premise that an



how to eliminate die costs in your experimental work...

USE OHIO PRECISION PLASTER MOLD CASTINGS

The use of Ohio Precision Plaster Mold Castings, made from Zinc Die Casting Alloy, for trimplates, coil housings, tuner front plates and escutcheons, saved Delco Radio Division, General Motors Corporation, the cost of expensive dies for experimental work on the new Delco radios.

These smooth-finished castings, held to a working tolerance of plus or minus .005", and with wall thicknesses as low as .050", are ideal for this type of work. For your experimental work, or when quantities do not warrant the cost of dies, look into Ohio Precision Plaster Mold Castings.

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Plaster Mold Castings made from
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aluminum die cast housing would be used, the first and most obvious improvement was to make the terminal connector housing as an integral part of one of the main housing members. This step eliminated one extra part that had to be stocked and one gasketed joint with its associated danger of leakage and increased assembly cost.

The redesigned switches had all of their components preassembled into a plastic block. The major function of the housing became, therefore, one of positioning this switch block and providing a water tight cover.

At this stage, the housing had been reduced to two thin-walled aluminum die castings in which the required lugs, bosses, etc. for mounting were incorporated. Closure in a water tight manner could, therefore, be accomplished by providing a rubber "O" ring molded to shape and size. When applied between the two cover members and placed under compression, it effectively sealed the two parts. Locking in the desired position is accomplished with a metal snap ring which fits into a groove in one of the housing pieces.

In the original design of the switch housing, the switch rods passed through the cover and were maintained water tight with spring-loaded packing glands. As redesigned, a shoulder is cast to act as a seat for an "O" ring which is held in compression by a washer

Direct-casting Electric Furnace for better, faster precision investment casting

Melting position *Casting position*

The new, type IC, 12 kw., 10-lb. Detroit Electric Furnace melts and pours heats of chrome-nickel, Stellite or superalloy steels in 9-12 minutes. Casting is done by inverting the furnace, pouring directly into the investment mold which is held in place by air pressure. Melting by fast, controlled, indirect arc minimizes carbon pickup and alloy variation. Simple, efficient operation is ideal for high production of precision castings.

Write for complete information.

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KUHLMAN ELECTRIC COMPANY
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Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Elsa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Cia Proveedora de Industrias, Atenas 32-13, Apartado 27A3, Mexico 6, D. F., Mexico; EUROPE, ENGLAND: Birlec, Ltd., Birmingham.

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MAYES LEVELS

DIE CAST in MAGNESIUM and ALUMINUM

- Light in Weight
- Strong, Durable
- Extremely Accurate

The President of Mayes Bros. Tool Mfg. Co. (one of the largest manufacturers of levels) brought this problem to Litemetal Dicast Engineers: He wanted a 28" Level die cast in both of the new lightweight metal alloys. Besides requiring lightness of weight for his product, he emphasized the absolute necessity of obtaining extremely close tolerances to the dimensions specified and the assurance of permanent alignment and accuracy. Litemetal Engineers not only met this challenge, but designed tools to manufacture this part adaptable for producing it in both magnesium and aluminum — making possible the choice of using either of these metals depending on conditions required.

Mechanically strong magnesium and aluminum not only offered savings in weight (reflected also in shipping costs) but further savings due to the virtual elimination of machining and consequent labor savings effected.

Let's Discuss Your Problem . . .

LITEMETAL DICAST, INC. is an organization of specialists—men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs—little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST, Inc.
A DIVISION OF HAYES INDUSTRIES
1925 WILDWOOD AVE • JACKSON, MICHIGAN
PLANT AND EXECUTIVE OFFICES

For additional information Circle No. 53 on the Reader Service Card

staked in place. When the switch rods pass through this seal, the rubber ring is under sufficient compression to give a moisture proof closure.

The switch housing as redesigned is shown in Figure 2. Nearly all of the changes made can be clearly seen if the two illustrations are compared. Even the locking nuts used to mount the switch on the dashboard have been changed so that by a staking operation, they are held more firmly in place and give a considerably longer thread for firmer holding than the type previously used. In addition, thread tolerances are undisturbed by altered method of fastening the nuts to the casting.

Overall cost reduction by this redesign is not known, as yet since the operation is still relatively new. It is known, however, that there has been a substantial reduction in material cost alone. Machining operations on the new housing have been virtually eliminated. The foundry, the Newton-New Haven Co. of New Haven, Conn., hold dimensions where required to ± 0.0025. This high degree of casting accuracy has eliminated machining except for a reaming operation on the bearing holes for the switch rods where clearance is held to a total of 0.0005.

Then it's Time to Call

Electronicast, INC.

for Centrifugal Investment Castings

You may be stumped for a complex part just like the manufacturer that needed the part shown above.

It had to be made of stainless steel and maintain close tolerances. Machining was prohibitive in cost, and the part was too complex for other types of casting. Then they called Electronicast. Here, skilled engineers quickly solved the problem with investment casting, and at a cost the manufacturer didn't dream was possible.

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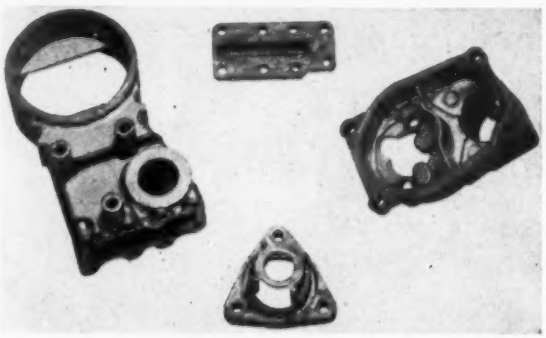

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Initially, these switches were given a 100 percent inspection. This has, however, been very materially reduced so that now only an occasional assembly needs to be checked. Normal hydrostatic checking, it may be noted, is under a head of 15 to 18 feet of water, some 2½ to 3 times the pressure required. Since the start of the use of newly designed housing, no units have failed due to leakage either at the four gasketed joints or due to porosity of the castings.

As a finishing operation, the die castings are given a chromate treatment as a prime coat followed by spray painting.

INVESTMENT CASTING
continued from page 45

investigate various types of organizations that might be set up. This committee will make its recommendations to the industry at a second meeting to be held in New York in about six weeks.

Roy Tindula, chief, Metals and Minerals Section of the Office of Technical Services, Department of Commerce, acted as chairman of this first meeting which was arranged by Precision Metal Molding magazine. At the meeting the industry and government representatives were guests of PMM at a luncheon.

Companies represented at the first meeting were: Adapti Co., Cleveland, Ohio; Alloy Precision Casting Co., Cleveland, Ohio; Arwood Precision Casting Co., Brooklyn, N. Y.;

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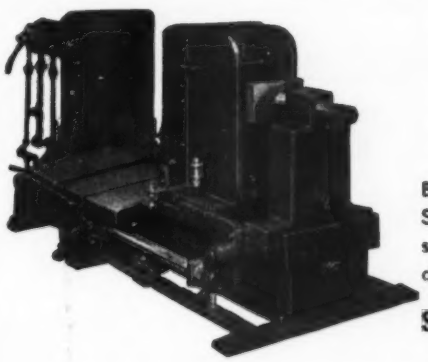

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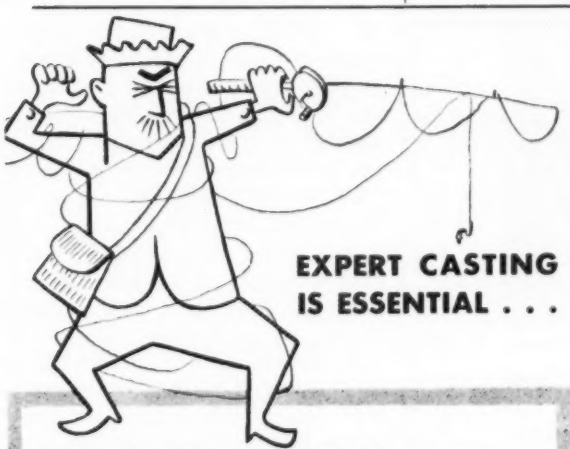

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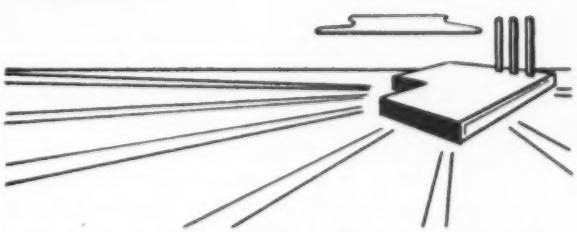

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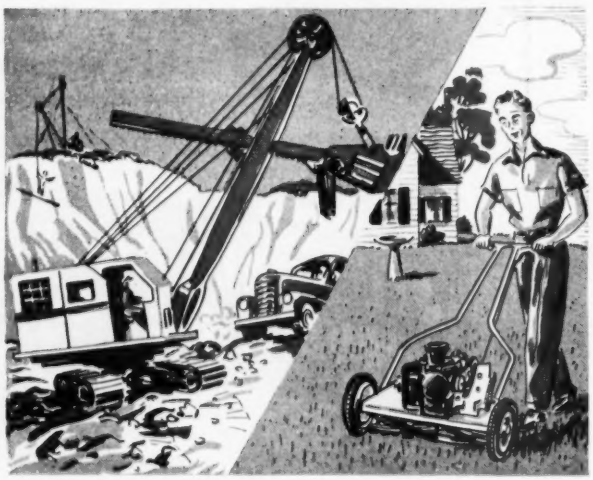

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LOW TEMPERATURE ALLOYS
continued from page 35

tin, lead, antimony, and zinc. This alloy is quite castable, has good corrosion resistance and is easily soldered.

At the Superior Meter Co., Inc., of Brooklyn, N. Y., many of the component parts are made as permanent mold castings in the alloy noted above. Figure 1B shows a cut-away view of a meter with a few of the permanent mold castings indicated.

Since most of the parts that are cast in permanent molds are quite small it is possible to use hand held book type molds almost exclusively. The alloy composition, while a trade secret, is rather variable depending upon the size and complexity of the casting being made. Pouring temperature will, therefore, vary considerably both with alloy composition and size of the casting, but generally fall within the range of 600F to 900F. No mold lubricant is used.

Some idea of the variation of sizes of casting that are made in these hand held book molds can be gotten from Figure 1B which shows two valve gratings, the largest and almost the smallest ones made.

continued next page

Most of the castings require only removal of the gate and riser and any flash that there may be to ready them for use. The one outstanding exception to this is the valve grating and its cover. Since these two parts must cooperate as a gas tight valve assembly the mating surfaces are ground to give the desired fit. Joining to other parts is done by soft soldering as indicated above.

In some places it is necessary to have brass inserts where wear is a problem. An example is the spectacle valve arm shown. In this part two brass bearings are cast as inserts, but before installation in the meter these inserts are heavily tin plated.

One other part indicated on Figure 1, but not separately illustrated that is of interest is the carriage yolk. This is a steel yolk having the solderable alloy cast on at the ends to give the desired operational characteristics.

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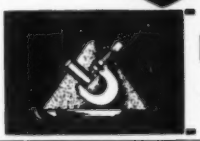

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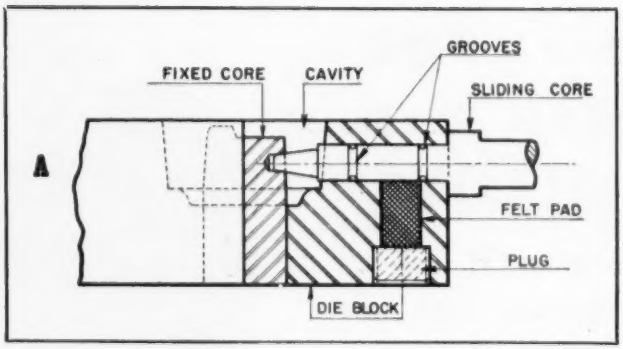
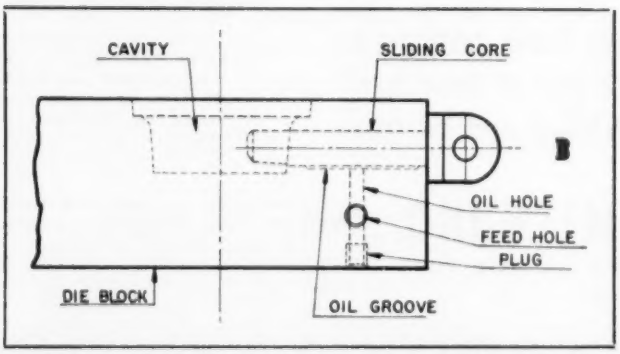
Methods of lubricating moving parts of DIE CASTING dies

By W. M. HALLIDAY*



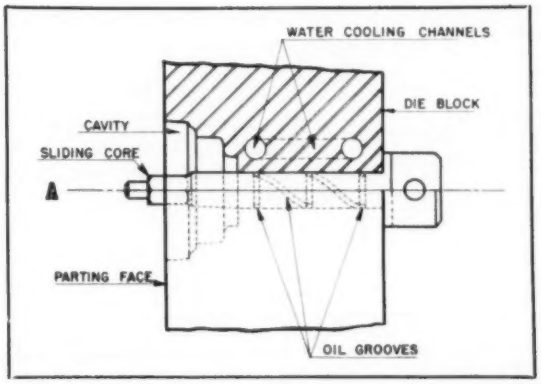


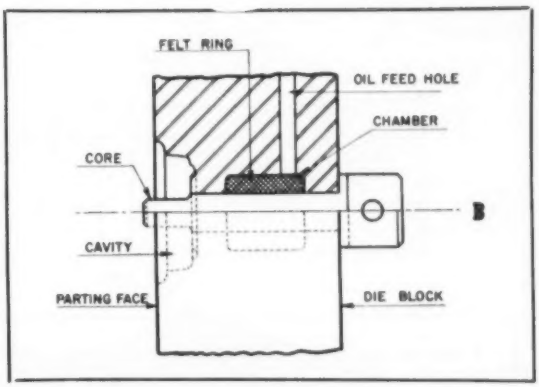
1. Instead of oil grooves fed from a reservoir, use a felt wick of the largest possible diameter whenever possible.

BECAUSE of the very high temperatures which die casting alloys and dies have to be worked, the great injection pressures used, the intricate character of die constructions, and the need to maintain closest precision in all operable die members, the provision of effective lubrication will be of the utmost importance.

Dies have to be specifically designed and constructed to incorporate the simplest, most direct, and permanent lubrication means to avoid the risks of stiffened working ox actual seizure of some critical movable member of the die.

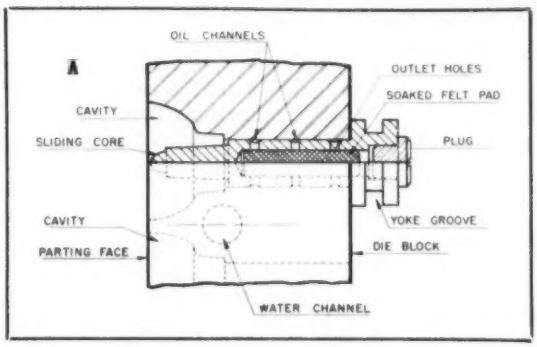
Lubrication problems are often aggravated not solely by the elevated temperatures employed, but by other equally important factors, chief of which the following may be noted as worthy of the closest attention from the die designer.

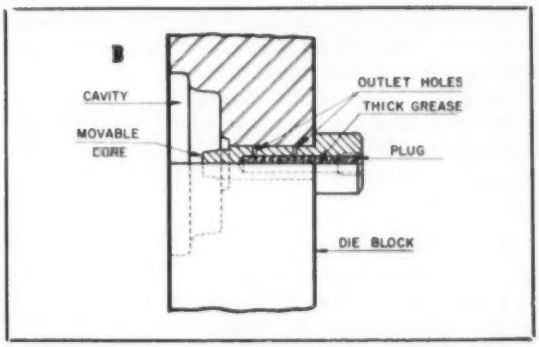




2. For long cores, a felt ring fed from an oil well is superior to annular rings which can oil flood the core.

3. Two types of lubricating from inside the core: "A" a felt core and "B" a solid grease core.





Some of the main lubrication problems:

1. The varying expansion and contraction of heated die elements. This may often be of such a magnitude and non-uniform character as to render it difficult to maintain reasonably fine working clearances between the various working parts, which is necessary to avoid producing unsightly and costly fins and flash on the finished die casting. Lack of smoothness and precision in the working of die members may also be developed from unequalized expansion or contraction.

2. The inability of ordinary mineral oils and/or vegetable-base greases to withstand sufficiently long exposure to the heated dies. Such lubricants speedily lose their lubricating qualities, and tend to burn away rapidly. They may leave undesirable residues in the form of gases, vapors, or scale. Presence of the latter feature may in course of time cause excessively stiffened working of the die, and the overloading of the operating mechanism, or a decrease in the speed of operation.

3. The necessity to prevent excess lubricant from entering the critical cavity area, or passing into runner or gate channels to make contact with the molten alloy charge. If this occurs, vapors may be formed which become easily occluded in the alloy charge in the cavity. Several harmful consequences may then arise.

Such vapors may produce staining or roughening of the highly polished walls of the cavity. This will be reproduced on the finished casting as rough patches, which may prove highly deleterious if the casting has to be finally electroplated.

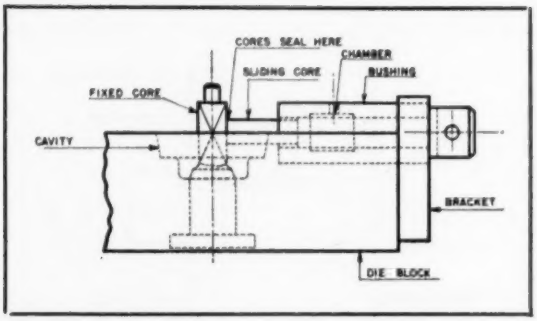
Such rough spots in the cavity may also impede ejection of the finished casting due to the tendency of the latter to stick or 'hang-up' at such points.

Occluded vapor, if trapped in the alloy stream is also one of the chief causes of internal porosity in walls of the casting. This frequently may prove a serious weakness in the strength of the part.

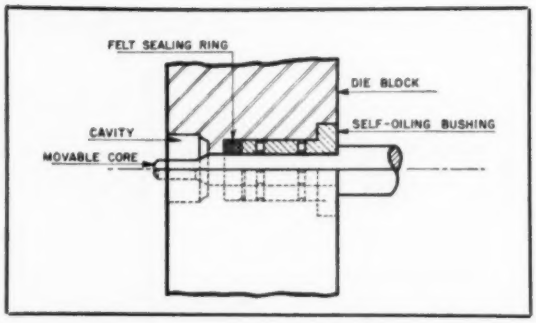
4. The accessibility of lubricant supplies in the form of suitable reservoirs capable of storing a sufficient volume of lubricant to meet the requirements of pro-

continued next page

*British die casting consultant.



4. A recess, machined into a hardened steel bushing, can be used for either a grease reservoir or to hold a felt ring.



5. For some applications self lubricating bushings can be used. Generally a felt ring will exclude excess oil from the die cavity.

longed continuous operation of the die, will also deserve most careful consideration at initial design stages. The introduction of built-in oil reservoirs may prove an invaluable means for minimizing later maintenance needs with the die, as well as ensuring smooth operation of the tool.

5. It will often be advisable to consider in what manner the entire lubrication system of the die can be safeguarded to ensure that lubricants will not flow into the vital cavity formations and runner channels. This will generally mean the adoption of effective sealing measures for cores, core-slides, ejector rods, and similar movable parts.

6. The selection of metals for the construction of various die elements has also to be judiciously studied in order that the best working combinations may be obtained, so as to minimize sliding or rotary friction between members. Such selections will be necessary too in order to obtain the most uniform expansion and contraction of the respective die elements.

Generally, the same, or a very similar grade of steel will be employed for both the main die blocks, and all essential working members located therein, such as cores, slides, and ejectors.

Die steels should be specified having the same rate of thermal expansion and stability features, as this will permit parts to be initially fitted together with the smallest working clearances and greater precision.

Working clearances: galling versus flash

It will be appreciated that such close working clearances will be necessary in the case of movable core plugs, or core-slides, because most die casting alloys are exceedingly free running. They may, in fact, be easily squeezed, under normal injecting pressures, into minute interstices or joint openings in the die. For example, zinc base alloys when pressure cast will readily flow into a joint gap of only .002, while aluminum and magnesium alloys will pass easily into openings of .003.

Should this take place, additional fins and flash may be formed on the sides of the finished casting. Thin slivers of metal entering such crevices may lodge for a long time, and can easily build up to such an extent as to cause very stiffened working of the core etc.

Alternatively, built-up joint-gap fins of this kind may cause the casting to stick during ejection, thus giving rise to numerous troubles, delays, and possible permanent distortion or inaccuracies in the casting.

However closely fitted such a core or slide may be within its die housing, a certain amount of working clearance will be essential for smooth operation and to give reasonable freedom from seizure or bind when the die is heated to the working temperature.

These risks of galling and binding and seizure between a slide or core and its housing walls will always be present despite special heat treatments and hardening of such movable parts according to customary practice. Unavoidable variations in die heat, the ingress of dirt, unequalized lubrication etc will be some of the chief factors tending towards such conditions.

Some alleviation of these tendencies may be derived from the use of specially tough, durable, stable and heat-resistant alloy steels for such cores or slides. By the greater difficulties experienced in machining such metals coupled with the additional material, machining and treatment costs may render their use uneconomical, especially when the die has to be used for producing a relatively small quantity of castings.

Even where large quantities of parts have to be die cast, permitting use of an expensive die, with working parts made from such superior alloy-steels, the question of lubrication will still remain, and will call for the most careful consideration.

Complex dies are more difficult to seal

The more intricate the die construction and the greater number of working parts, the

more difficult will be the solution of the lubrication problems.

It will not then be solely a matter of applying a proper supply of suitable lubricant to feed movable members in their heated state; special precautions will usually have to be adopted to prevent lubricants flowing to unwanted portions of the die. In other words some sealing provisions will usually have to be employed in conjunction with the lubricant flow system.

According to the type, location and mode of operation of movable core-slides and core-plugs will depend the methods of lubricating and sealing same. The temperature of the die, the kind of casting alloy, and the disposition of cavities relative to cores will also influence the character of the lubricating measures to be employed, together with effective seals.

For instance, with low melting point alloys such an antimonial lead, tin-base and zinc-base materials, where the melting temperature does not exceed about 400 C for use with which dies can be operated satisfactorily at a temperature range of 100 to 150 C lubrication of movable parts may be relatively simple. This will be the case with dies of the simplest design forms, but where the construction is complex and comprises a number of movable cores certain difficulties may arise.

Lubrication of dies for higher temperatures

The attendent factors of cavity location, amount of interjection of cores into cavity formation, the size and number of cores, and/or core-slides to be moved, and the extent of such operating movements will also influence the kind of lubrication system to be adopted.

On the other hand, greatest objections will occur in respect to successful lubrication of die parts with tools required for use with the high melting point alloys such as aluminum, magnesum, and brass where the melting points range from 1100

continued next page

There is a theory that a man who specializes in mouse-traps will build better mouse-traps than one who makes merely wood or metal products. This is the narrow view of the self-conscious specialist.

Others say, "Specialists are those who know more and more about less and less," which invites the conclusion that the greatest specialist of all must be he who knows everything about nothing.

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DIE LUBRICATION — cont.

to 1650 C necessitating working temperatures on the die up to 500 C. Conditions of this latter character will often prove highly inimical to sustained and efficient lubrication of the moving parts of a die. For these reasons it will always be advisable to establish the best means of lubrication before the die design is finalized and actual toolmaking operations begin. If consideration of such provisions is deferred until the die has been almost completely constructed, it may be found that the intervention of other die members will prevent use of the best type of lubrication system.

The following illustrated examples of typical lubrication practice and feasible applications for different constructions of die casting dies, will be found useful to indicate preferred and undesirable methods.

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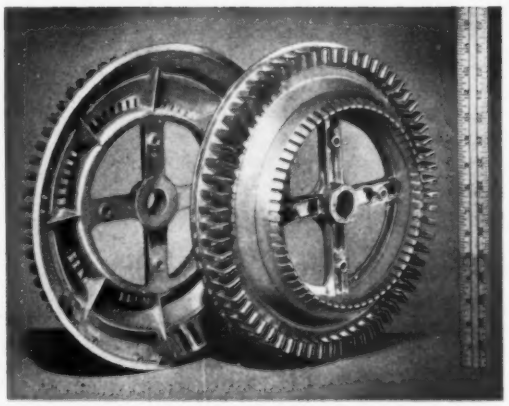

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The diagram A Figure 1, shows a very common coring arrangement. This comprises a short cylindrical core plug disposed with its axis parallel to the main parting joint of the die, and having to interject into the die cavity in such a manner as to interlock with a fixed core plug situated permanently in the die block at right angles to the main parting joint. The sliding core, in this case, has only a short length of travel, and may be actuated by a simple manual lever, or by cams automatically operated from the machine slide movements.

The lubrication requirements to be satisfied with this arrangement will be comparatively simple.

The effective method shown comprises two or more annular grooves, of shallow depth, being machined around the shank of within the die block. A large diameter hole is drilled crosswise through the die block, at right angles to the core housing, and passing fully therein. A felt pad is inserted in this hole, being retained by means of a screwed plug in the mouth of the hole. The pad at its opposite end lightly bears against the side of the core plug. Lubricant, in the form of some graphite-oil mixture will be soaked into the felt pad initially when completing the die, and later at required intervals. Access is afforded to felt pad for replenishing the lubricant supply by removal of the screwed plug.

It will be specially noted that the felt pad is situated a substantial distance away from the adjacent wall of the die cavity.

The heat of the die block and core will cause the lubricant in the pad to liquify in gradual manner, and to be deposited on the sides of the core in the form of a fine film, as the former undergoes each sliding movement.

Furthermore, use of a felt pad in this fashion will ensure that the sides of the core will be wiped clean at each movement, the pad tending to pick-up small particles of casting metal,

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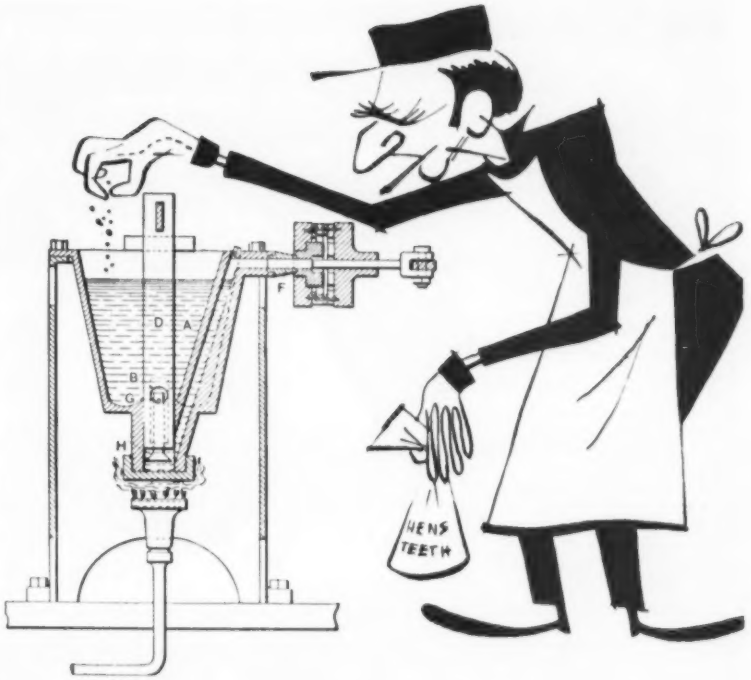

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DIE LUBRICATION — cont.

dirt, residues etc. The pad will also serve to some extent as a seal and safeguard against applying an excessive amount of oil to the core at any single pass.

This method of lubrication will be superior to the more conventional form as illustrated at B Fig. 1. With this latter method lubricant in the form of a graphite-mineral oil mixture is applied at very frequent intervals during a production run on the die, via a small feed hole drilled in the die block and leading to the core housing as shown. The feed hole is plugged on the outside wall of the die block.

Where the feed hole breaks into the core plug housing a shallow oil groove is machined for almost the full length of the bearing hole, from which the core picks up oil at each movement.

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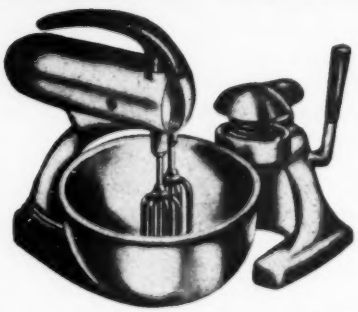

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of oil during use of the die, certain other drawbacks are worthy of observation.

Delivery of lubricant to the critical housing and core will be extremely unequal in volume. An excessive amount will pass to the core immediately after re-charging the inlet hole. This will quickly run away and after a short time no lubricant will pass to the core.

The oil groove in the side of the housing extends very close to the wall of the cavity, and unless the core is maintained an exceedingly close fit in the die block bearing hole at this point surplus oil will inevitably find its way into the cavity, with liability to the troubles previously mentioned.

There will be great tendency for the oil to remain at the lowest side of the bearing hole in the die block, thus the core may lack adequate lubrication at one side, a feature which would quickly lead to binding and possibly seizure.

Sliding core wholly contained in block

Diagrams in Figure 2 show other useful forms of lubricating a sliding core, which is wholly contained within a housing in one of the die blocks.

The section view A shows a cylindrical core plug of relatively long length, and which has to interject into the cavity area for a considerable distance, thus requiring a long length of travel, in a direction at right angles to the main die parting joint.

With this die lay-out the cavity is situated a considerable distance from the outside edges of the die block, on account of which it is impracticable to employ a cross-drilled hole for a felt pad of the kind shown in the first example.

To lubricate the core plug in this case, a series of shallow annular grooves may be cut around the shank of the core, spaced at regular intervals, these being connected together by short helical channels of the same depth and width.

Before mounting the core plug, the various grooves would be filled with a stiff paste mixture of heavy grease and flocculated graphite. Several applications of new lubricant would be required daily on continuous production runs.

Diagram B Figure 2 shows an improved form of lubrication for an almost identical core arrangement, which ensures adequate lubrication of the part over much longer working periods.

With this example it should be noted that water cooling channels are not located near the core housing as with the previous design. This renders it possible to employ a substantially enlarged chambered portion in the middle of the bearing hole. A felt ring is inserted into this chambered portion, and the hole in the ring is

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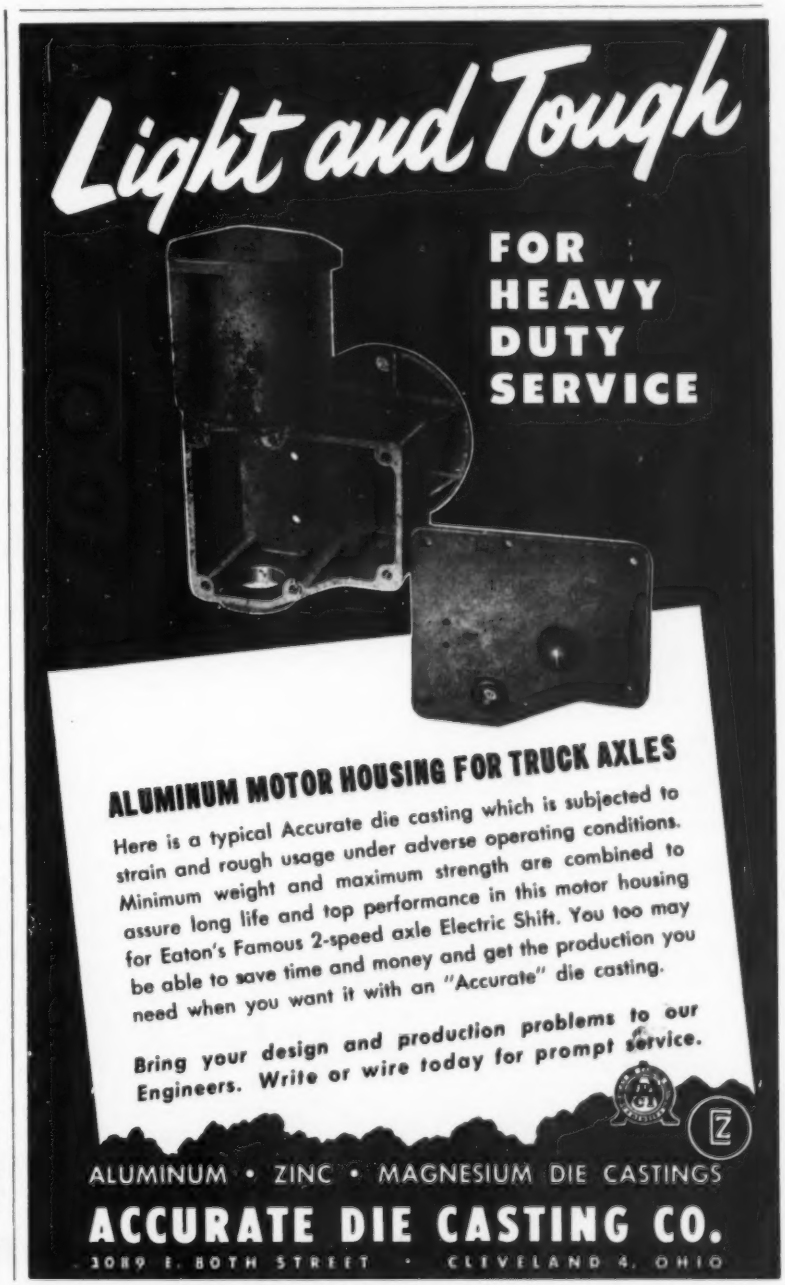
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a close fit over the shank of the core. An oil-feed hole is drilled through the die block, from its most convenient outside edge to pass into one end of the chamber, preferably that most remote from the cavity.

Grease-graphite lubricant would be used, the felt ring being well impregnated before installing in place.

As with a previous example, the felt ring, while ensuring the requisite film of oil on all sides of the core, will also act as a seal preventing any surplus passing to the left and into the cavity.

With the two forms of core lubrication shown in the diagrams at Figure 3, lubricant is actually stored within the core itself, that member being hollowed out in special manner.

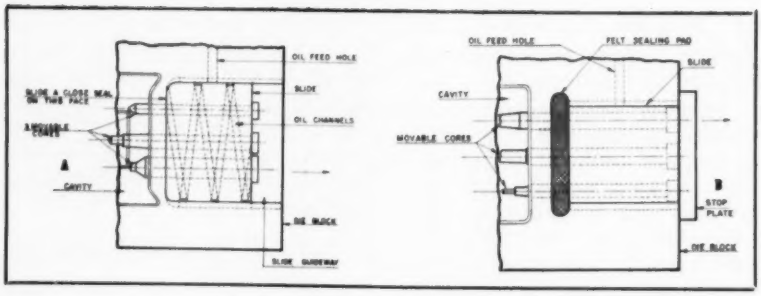
The first design at A is particularly effective, time-saving, and economical, but is only applicable with core plugs having a fairly large shank diameter guided in the die block housing.

In the case shown, a number of annular grooves or channels are machined at intervals around the shank of the core. The member is bored up the center for a specific depth to receive the oil impregnated felt or fabric pad as shown.

This is retained in place by a headed screwed plug threaded into the enlarged right hand end of the core plug, which on its exterior has the usual yoke groove for being actuated by a forked lever.

A number of small diameter outlet holes are drilled through the wall of the core plug, from the base of one or other of the annular channels on the outside.

The felt pad, being of substantial size, will contain a considerable volume of lubricant, which will slowly percolate



6. Machining of oil rings in the die block (A) can be avoided by the use of a felt retaining ring (B) and flood lubricating back of it.

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through the small holes, and into the annular channels to provide the desired film of oil on all bearing surfaces in contact.

With the second design shown at B Figure 3, no felt pad is employed inside the sliding core plug, owing to the small diameter of this member. Instead a small blind hole is drilled therein, and exceedingly minute outlet holes are drilled in the wall of the corer. Thick grease lubricant is stuffed into the bore of the core, and is retained by a small screwed plug.

The first design A is to be preferred wherever possible because of its far more prolonged lubricating capacity, and the much less attention required.

Machined recess for grease reservoir

The die construction shown at Figure 4 illustrates another very common method of mounting a core plug, which often raises difficulties in respect of lubrication.

In this example the core plug has its axis on the main parting line of the die, and has to slide laterally parallel with that parting line. The forward end of the core passes partially through the cavity to abut closely against the side of a stationary core plug mounted in the die block at right angles to the parting joint surface.

The core is a sliding fit within a hardened steel bushing, which in turn is mounted fixedly upon a bracket fastened to the side of the die block. Half the diameters of the bushing, and core plug projecting therefrom are a close fit within a similar shaped hole in the mating die block (not shown).

With this arrangement it will be permissible to employ a chambered recess in the bore of the bushing into which a supply of thick grease, or an impregnated felt ring may be inserted to lubricate the sliding core within. A small inlet feed hole may be provided in one side wall of the bushing to lead into the chambered portion. The shank of the core plug sliding within the bushing may be grooved as with previous examples to facilitate more uniform spread of the oil film.

Illustration Figure 5 shows a sliding core plug adapted for guidance within a special self-oiling metallic bushing which is mounted in the main die block. This bushing should preferably be of the headed kind, with that formation being fitted within a recess machined in the outside edge of the die block. Small holes may be provided in the walls of the bushing, to give better spread of the film.

The core plug may be made an easy sliding fit in bushing because the actual guiding portion of the housing nearest the cavity is comprised wholly in the die block itself. This feature will give useful compensation for the differences in thermal expansion between the die block

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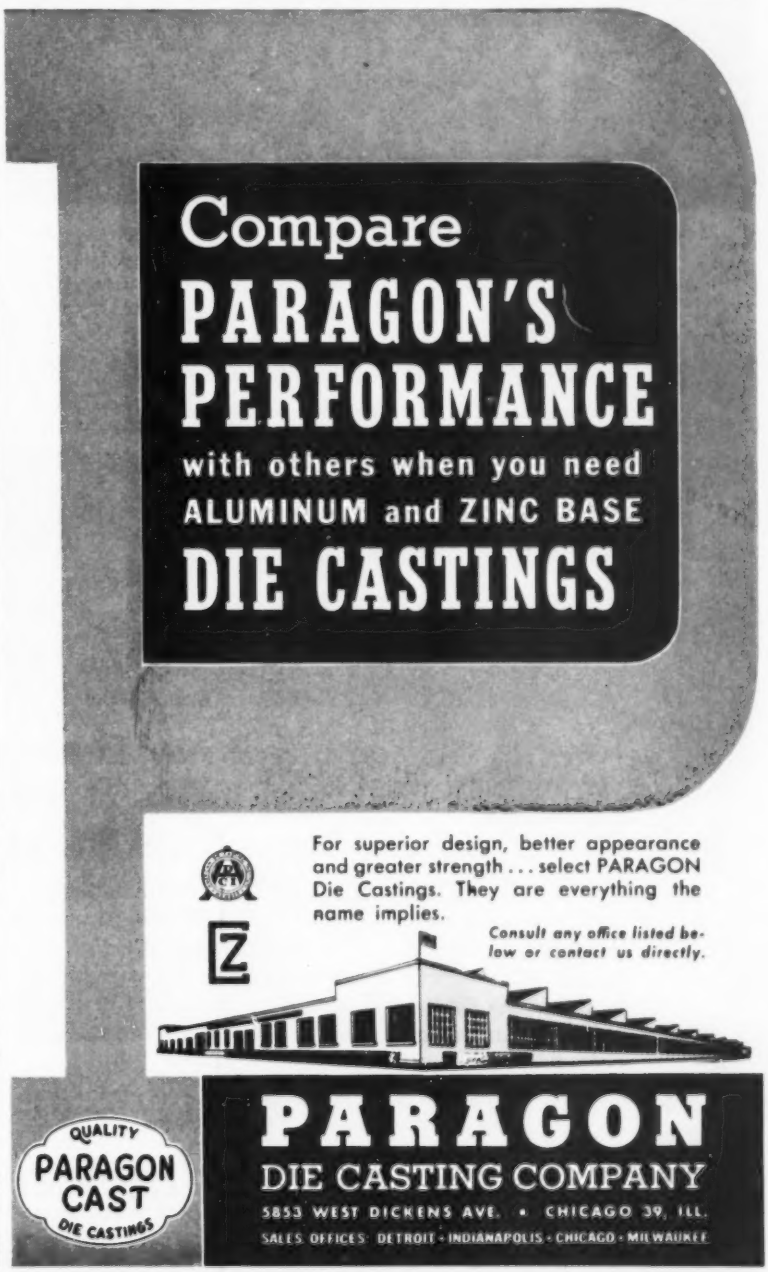
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metal and the bronze self- oiling bushing.

Because of the short length of the true guiding hole in the die block adjacent to the cavity wall, it will be advisable to employ some sealing agent to prevent excess lubricant penetrating into that formation. With this lubrication system lay-out this is easily accomplished by using a thick felt ring, interposed between the bushing and the shoulder in the bearing housing in the die block, formed by the two diameters of the hole.

A certain amount of lubricant will flow gradually from the bushing into the felt ring, which will still further promote uniform distribution of the oil film.

The great advantage with this method is that little or no attention will be required to replenish the stock of lubricant, it being only necessary to extract the bushing occasionally for this purpose.

The illustrations at Figure 6 show certain lubrication problems occurring with the use of movable core-slides of conventional type.

The typical example at A shows a parting-joint view of a die block in which a large size cavity is sunk. Three core plugs, of different size and shape, have to interject different distances into this cavity, these cores being situated parallel with the parting joint surface.

The three cores are affixed within a reciprocating slide carried in stepped guideways in the die block. All sides of this slide, coming into contact with the walls of the guideway, are grooved in the manner depicted in light broken line, so that oil may flow over three sides. A feed hole is provided in one side of the die block to pass into the slide guideway.

This method of lubrication would prove unsatisfactory for two reasons. First, because of the narrowness of the wall of die block metal between end

of slide guideway and die cavity, wear of the core guide holes through that portion would rapidly occur, leading in turn to leakage of oil into the cavity.

Secondly, it will be essential that the left hand side of the slide shall very closely match up with, and seal onto, the side wall of the guideway lying parallel with the side of the die cavity.

Slight deficiencies in such sealing would allow surplus lubricant to pass very easily into the cavity area, both along the sides of the core plugs, and across the parting line surface of the block.

A much more reliable arrangement is depicted at B, Figure 6. The three cores are affixed within a slide as before, but to the opposite end of the latter is fastened a stop plate whose purpose is to limit the amount of inward movement of the slide relative to the guideway. This movement is determined accordng to the amount of projection required by cores into the cavity, and in order to leave a certain amount of space between the inner end of the slide and the bottom of the guideway.

At this point the guideway is considerably widened to take the felt of other fabric sealing pad, which may be impregnated with a suitable lubricant.

When the slide is moved to the innermost (casting) position along its guideways the felt pad may be lightly compressed. The cores pass through holes provided in the felt pad, which serves to apply a small supply of oil at each movement. The pad, by being fitted into an enlarged portion of the guideway will remain stationary during the actuation of the reciprocating slide.

A feed hole is provided in one side of the die block to pass into the slides guideway as before, and in the interests of better distribution of the oil supply, with slides of large surface area, the member may be grooved in the manner shown in the preceding example.

The felt pad performs the dual function of lubricating the three core plugs passing through the guide holes in the die block to the left of the slide guideway, and to seal the guideway and bearing holes against excess lubricant tending to run into the cavity area.

These examples will suffice to illustrate the importance of die lubrication, and indicate the various objectionable features to be avoided with respect to certain conventional coring and core-slide practice. These examples by no means cover all the numerous lubrication problems arising with differrent core constructions, but they will doubtless proffer good indication of the most satisfactory method of approaching a solution.

It is worth while mentioning too, that many of the lubricat-

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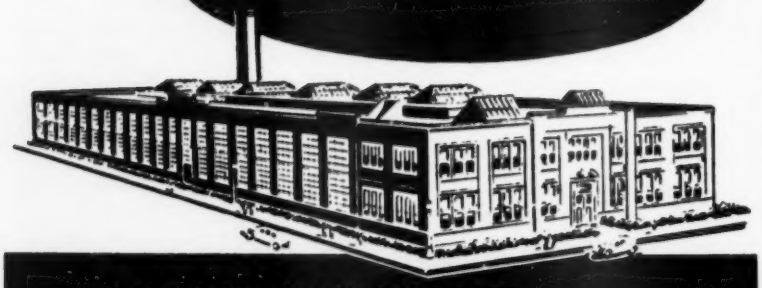

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ing and sealing methods here illustrated will be applicable with equal practical benefit to ejector rod mechanisms.

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Considerable trouble can in fact, be occasioned by unsatisfactory lubrication of ejector rods, due partly to the fact that with the general run of die casting dies, a much larger number of these members will be employed than is the case with cores. Moreover, ejector rods will generally be much smaller in diameter and have to be moved much greater distances than cores. Thus they are very prone to binding, wear or seizure.

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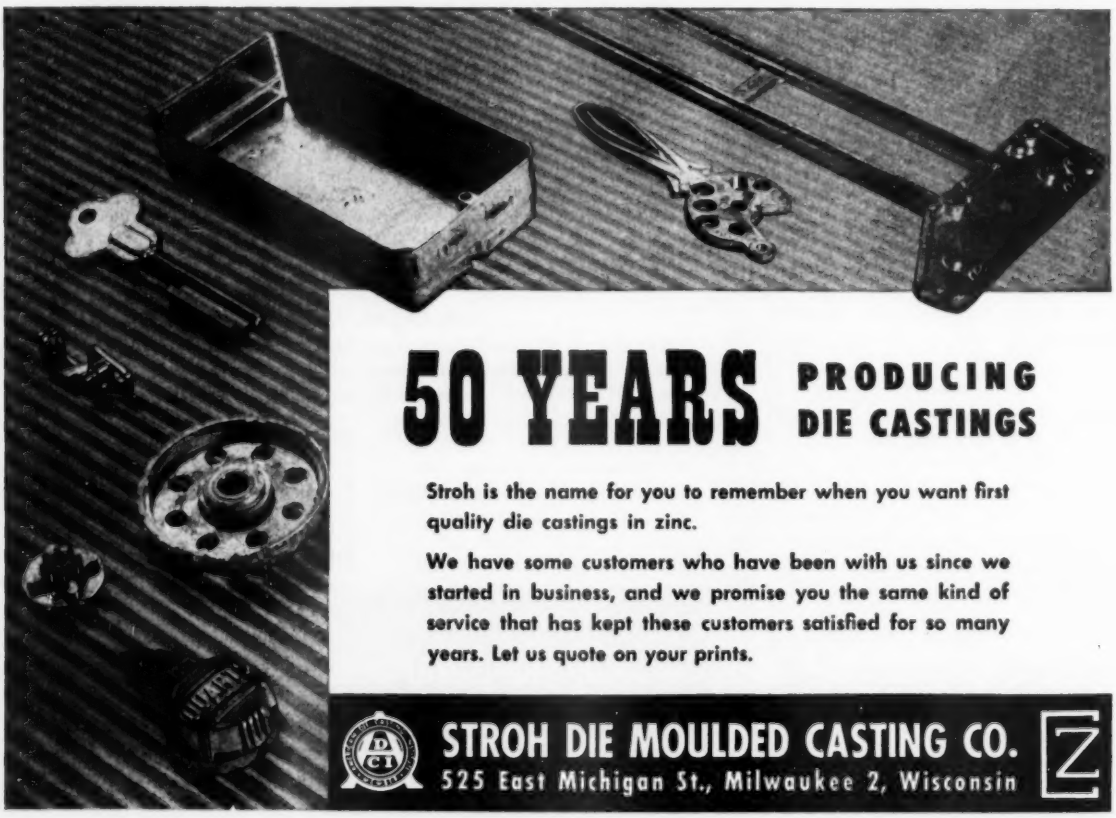
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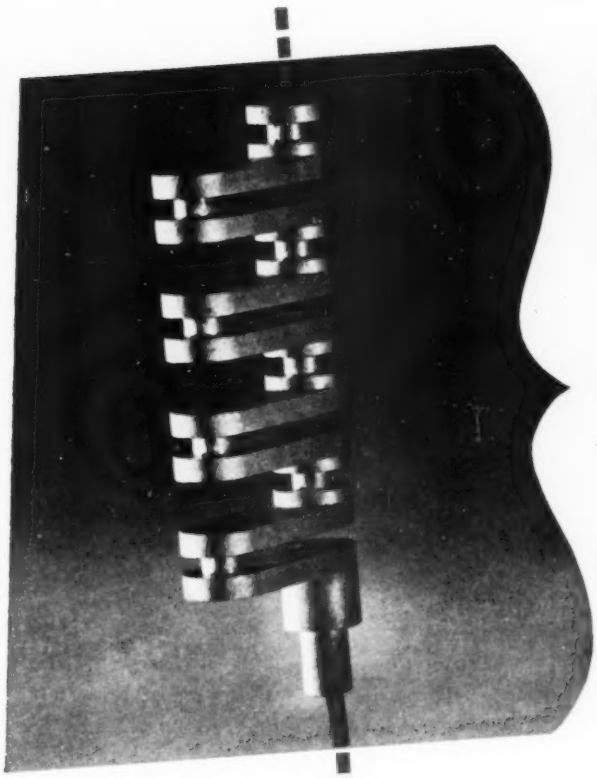

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